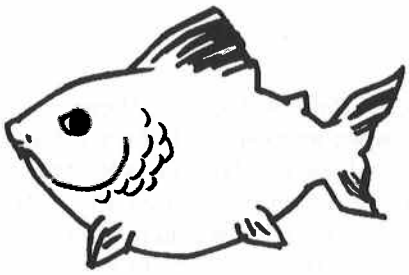


Louis The Fish

(GPN # 5)

Author: Arthur Yorinks
Illustrator: Richard Engielski
Publisher: Farrar, Straus & Giroux

Science Comes Alive
Science Connected

Program Description: LeVar explores exotic marine life, tide pools, and dolphins as he visits the New England Aquarium in Boston, and the Aqua Circus of Cape Cod.

It's In The Water

Key Words: *Fish, gasses, water*

Concept: *Fish breathe gasses that are in water.*

People—like all mammals including Dixie and Dolly, the dolphins in this episode—get the oxygen they need from the air. Fish and many other sea animals get oxygen from the water they live in. Fish take in water (which includes oxygen) through their gills. Some other water animals, like soft-shelled turtles, take in oxygen from the water through their skin. Water contains gasses like oxygen and carbon dioxide.

Materials: Chopped red cabbage, water, pan, heat source, straws, small clear plastic cups, paper towels, fish tank (optional).

1. Boil 1 cup of chopped red cabbage in 1 cup of water to create a blue liquid that will turn purple when carbon dioxide is dissolved in it. For a larger amount, increase the recipe by keeping the cabbage to water ratio 1–1.

2. Pour at least 1" of the blue liquid into small cups. Give each group of students two of these cups and enough straws for each student. Have a group member use a straw to blow air into the liquid in one of the cups. Ask students to compare the color of the liquid in the cups. (*They will see the color of the liquid change from blue to purple.*) Explain that the color change is caused by carbon dioxide, which was blown into the water. When carbon dioxide dissolves in water, it forms carbonic acid and causes the color to change.

3. Have them release the gas by vigorously stirring the water with a straw. After the carbon dioxide is released, the water will return to a blue color. Have students take turns doing this (using their own straw, of course) until each group member has had a chance to experience the change.

4. To live, fish need oxygen which is also a gas dissolved in water. If there is a fish tank available, have students look for ways that oxygen is being introduced into the water. Ask students why it wouldn't work to keep fish in a jar with the lid on. (*The fish would eventually use all the oxygen, and the lid would keep oxygen from entering the jar and the water.*)

Science Note: Some tanks have an aerator that forces air bubbles through the water and causes oxygen to be dissolved. Oxygen is also introduced at the surface. Tanks usually have filters or pumps that circulate the water and as the water moves it is exposed to oxygen in the air at the surface. Water plants also release oxygen.

Streamlined Racers

Key Words: *streamlined, fish, dolphins*

Concept: *Many water animals have body shapes that help them move quickly in water.*

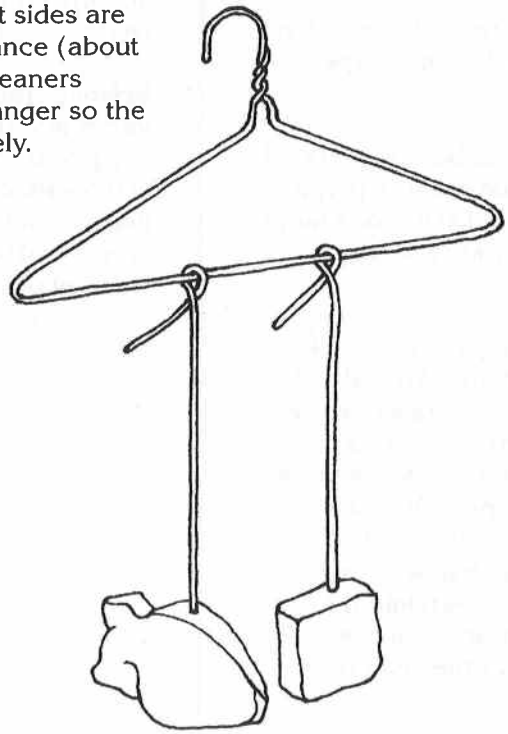
Because water is denser than air, moving in it can be more difficult. If you've tried to run in water, you know it can really slow you down. This isn't a problem for fish and water mammals like Dixie and Dolly because they have smooth, slim, streamlined bodies that move easily through water.

Materials: Oil-based modeling clay, pipe cleaners, wire clothes hanger, sink or large tub of cool water.

1. Give pairs of students a stick of clay, two pipe cleaners, and a clothes hanger.

2. Have students divide the clay in half, and use half to make a flat cube. With the other half have them make a slim, smooth, ocean animal such as a dolphin or shark. This kind of shape is called "streamlined."

3. Have them push the end of a pipe cleaner into the top center of each of these shapes, and use the pipe cleaners to hang the two shapes on a clothes hanger. They should make sure the ocean animal and one of the cubes large flat sides are both facing forward at the same distance (about 8"–10") from the hanger. The pipe cleaners should be loosely bent around the hanger so the shapes can swing back and forth freely.



4. Holding the top of the hanger, have them submerge their shapes into one end of a tub filled with about 6 " of cool water. The goal is to race the two shapes to see which moves faster in water. For the race to be fair, they must pull the hanger so that the tops of the pipe cleaners are even throughout the race; the water will push against each shape, but will push one more than the other. Have them predict what will happen.

5. Race the objects by pulling the hanger in a straight line to the opposite end of the tub. Which shape reached the opposite end first? (*The streamlined shape*) After repeating the race several times, have students further streamline their water animal and race again. Ask them to explain the race results. (*The streamlined shape moves quickly and easily through the water because, unlike the cube, the water does not directly hit against it to push it back. Instead the water slides easily past it.*)

Extension: Research other water animals to make models of and race. Students will find that not all have streamlined bodies. Some water animals don't need to move quickly in water. An example is a sea urchin, which is protected by spines so it doesn't need to run away quickly or move quickly to catch its food.

The Magic School Bus Inside The Earth

(GPN # 66)

Author: Joanna Cole
Illustrator: Bruce Degen
Publisher: Scholastic

Science Comes Alive
Science Focused

Program Description: What's inside the earth? As LeVar goes "spelunking" (cave exploring) in the California Caverns with a cave expert, he discovers some fascinating mineral formations—including stalagmites and stalactites which form at a very slow rate.

Rock Stories

Key Words: rock, description, observation

***Concept:** Rocks are each unique, but they are also the same and different in a variety of ways.*

Have each student bring a rock to class so they can do some rock exploring activities.

Materials: A variety of rocks (enough for one per student), paper, pencils.

Rock Groups

1. See that each student has a rock and then divide the class into small groups.

2. Ask each group to compile a list of all the words they can think of that describe one or more of their rocks.

3. When this is done, ask one group to write all of their descriptive words on the board, then give the other groups a chance to add words from their lists.

4. Read each of the words and have students raise their hands if the word describes their rock. Tally the hand count and record it by each word.

5. After the count is completed, circle the five words that describe the most rocks, and ask students what a rock that was described by these five words would look like. Ask students who have a rock fitting this description to hold it up.

6. Underline the five words that describe the fewest rocks, and ask students what a rock that was described by these words would look like. Have students hold up their rock if it can be described by these five words.

My Rock

1. Have students record observations about their rocks on a sheet of paper.

2. Next have everyone place their rocks into a pile and mix the rocks together.

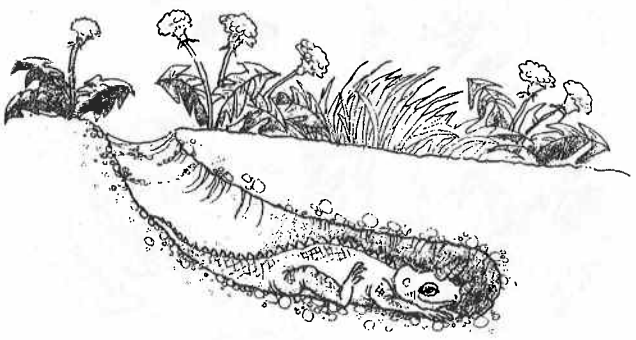
3. Ask students to find their own rock and explain how they know it's theirs.

4. Place the rocks in a pile again. Have students trade observation pages, so others can use the description to locate the rock it matches.

Stone Query

1. Have students create a history of how they found this rock (e.g., why they chose this rock over others, where it was found, what they were doing just before and after they found it, etc.).

2. Display this description with the rock.



Just Right Stalagmite

Key Words: *stalagmite, stalactite, model*

Concept: *Models can help us understand processes that form rocks.*

Some of the most interesting features of limestone caves are stalagmites and stalactites. These formations grow as water drops deposit minerals on the ceiling (stalactites) and floor (stalagmites) of caves. Create a prototype of the stalactite and stalagmite formation process.

Materials: Two cups of Epsom salts, water heated to near boiling, measuring cup, four eight-ounce disposable cups (appropriate for hot water), tape, shoelace, metal washers or similar heavy objects, flat sponge (4" x 6"), cake pan.

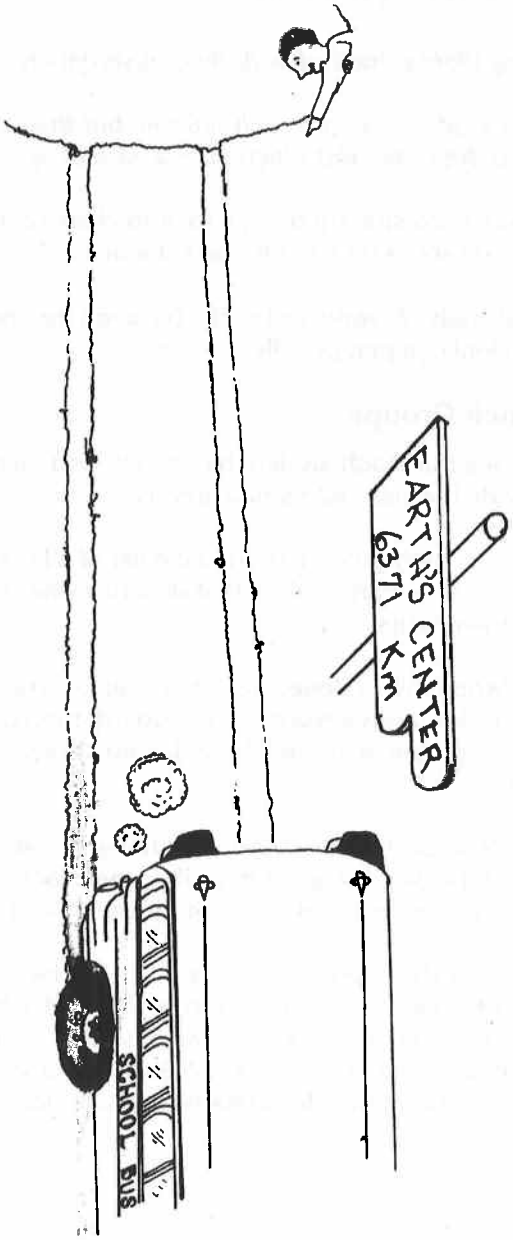
1. Tape two, eight-ounce cups bottom to bottom—so one is facing down and the other is facing up. Repeat this with the other two cups. Place both sets of cups in the pan with the sponge laying flat between them.

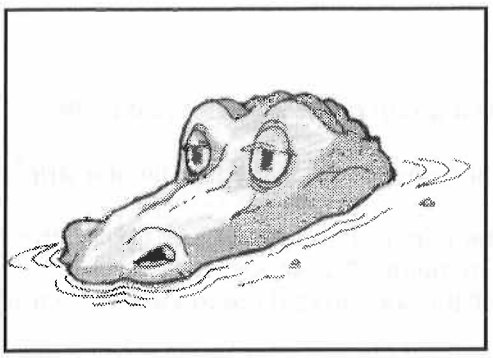
2. Tie a metal washer or other heavy object to each end of the shoelace and place an end of the shoelace with the washer in each cup. Arrange the shoelace so that it droops between the cups, near the bottom of upper cup.

3. Add one cup of the hot water to two cups of Epsom salts and stir until the salt dissolves, then add a second cup of hot water and stir again. Fill each of the shoelace-holding cups with this mixture.

4. The shoelace will absorb the Epsom salt water mixture. As the mixture moves down the shoelace, it will drip onto the sponge. Over the next several hours (or overnight), the Epsom salts will form stalactite (on the shoelace) and stalagmite (on the sponge) shapes and the water will soak into the sponge.

5. Discuss that this is a model—clarifying that the water in caves is not hot, that these formations take years, and that the Epsom salts represent the mineral formations.





Mama Don't Allow

(GPN #30)

Author: Thacher Hurd
Publisher: HarperCollins

Science Comes Alive
Science Connected

Program Description: LeVar takes a trip deep into the swamps of Louisiana to visit an alligator farm, journeys down the Mississippi on a riverboat, learns about creating sounds from a mouth-sound performer, and meets one of New Orleans' hottest jazz saxophonists.

Alligator Two Step

Key Words: *alligators, reptiles, dinosaurs, movement*

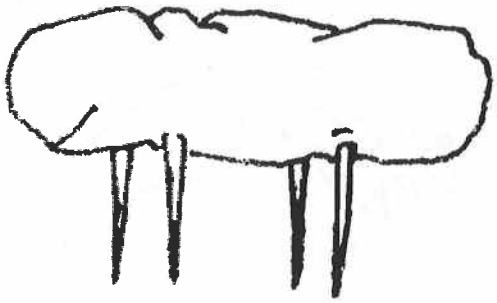
Concept: *Reptiles walk with their legs held out to the side of their body.*

In this episode, alligators remind LeVar of dinosaurs. Alligators and dinosaurs are similar in many ways, but one important way in which the two are different is in how they walk. Reptiles walk with their legs held out to side of their bodies, but dinosaurs walked with their legs directly under their bodies, similar to how dogs or cats walk. Because dinosaurs walked in this way, their legs were able to carry greater body weight.

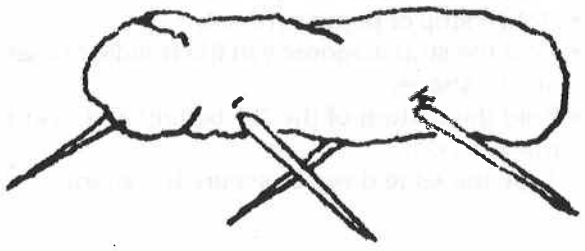
Materials: Oil-based modeling clay, toothpicks.

1. Have students roll a stick of clay into a cylinder shape that is about 4" long x 1" in diameter.

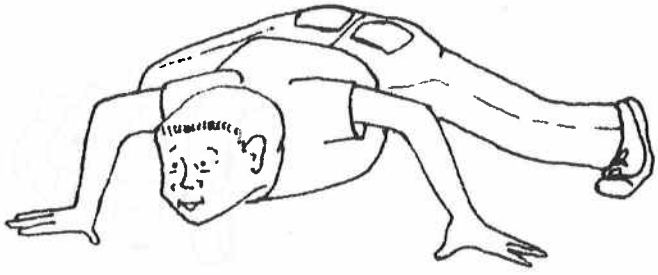
2. Ask them to imagine that the clay cylinder is the body of a dinosaur. Have them insert four toothpick legs into the clay, positioning the legs directly under the body of the dinosaur. Stand the models up on a flat surface.



3. Now ask them to imagine that the clay cylinder is the body of an alligator. To make it an alligator, the four toothpick legs must be moved to the sides of the clay cylinder. Have them stand the model up on a flat surface and describe what happens. (*With the legs in this position, the model will not be able to support the weight of the clay body.)* Ask students to reduce the size of the clay cylinder until the model can be supported with toothpicks in this position.



Extension: Have students mimic a dinosaur by walking on all fours with their legs and arms directly under their body. Then ask them to mimic an alligator walking on all fours with their arms and legs held out to side of their body. Ask them to describe how each position feels. (*It will be much easier and less awkward to support their weight with their arms and legs under their body than with them out to the side.*)



The Point Of Teeth

Key Words: *alligators, teeth*

Concept: *Alligators have cone-shaped teeth.*

The naturalist, Heather Burden explained that alligators can replace lost teeth—some have as many as 3,000 teeth in a lifetime! One reason alligators need to replace so many teeth is that they use their teeth for grabbing and holding onto their prey. They don't use their teeth for chewing food as we do. In fact they generally swallow their food whole or in large chunks. Their teeth are shaped like tiny cones—a great shape for grabbing and holding on.

Materials: Large tube-sock, plastic bags, string, index cards cut into strips that are 1" x 3", tape, scissors.

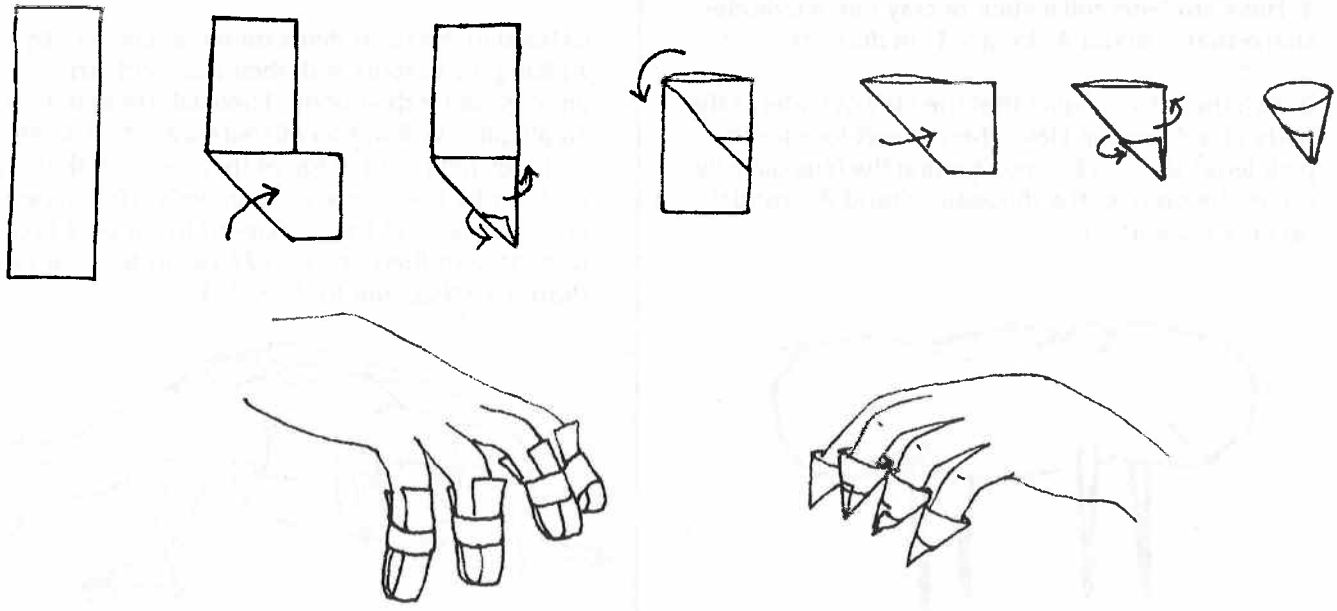
1. Have students compare the ability to grab and hold things with pointed and flat teeth shapes. They can begin by making something to grab. Fill a sock with plastic bags, and tie the end closed with string.

2. To make pointed teeth, have each group of students make 8 cone shapes.
   - Hold a strip of paper vertically.
   - Fold the strip diagonally in the middle to make an "L" shape.
   - Fold the bottom of the "L" behind and over to make a cone.
   - Tape the edge down to secure the shape.

3. Have each group make 8 flat-topped teeth shapes.
   - Place an index finger in the middle of a strip of paper.
   - Fold the paper up in front of and behind the finger to make a "U" shape.
   - Tape all the way around the top to secure the shape.

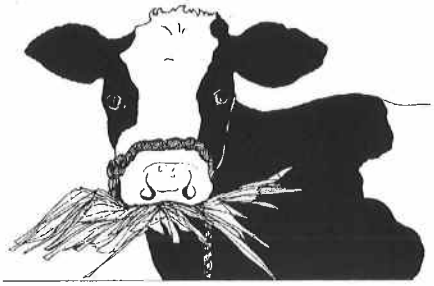
4. Have students place the flat-topped teeth shapes on their four fingertips (not the thumbs). To mimic the motion of an alligator's jaw, have them place their elbows together, fold their thumbs in, and curve the fingers down to form the teeth. Ask another student to hold the sock while they use all 8 fingertips to grab it. The sock holder should gently try to pull it away. (*The sock pulls away easily.*)

5. Have students place the pointed teeth shapes on their fingertips and repeat the same actions. Can the sock be pulled away as easily? (*No, the points of the cone-shaped teeth hold the sock better.*) Discuss why they think alligators have the shape of teeth they do?



The Milk Makers

(GPN # 32)



Author: Gail Gibbons
Publisher: Atheneum

Science Comes Alive
Science Focused

Program Description: One of nature's most nutritious foods is milk! This program takes LeVar to California's dairy country, where he gets a lesson on how to milk a cow by hand, learns how this delicious liquid travels from dairy cow to the neighborhood supermarket and sees how cheese is made.

Homemade Butter

Key Words: *cream, fat, energy*

Concept: *Milk contains fat globules which can be made to stick together, forming butter.*

Shake up a batch of butter. When cream is shaken with enough force, the fat globules in the cream stick to each other and this creates butter. (Stirring does not create enough force.) Butter is a source of fats, which the body uses for heat and energy. Butter also contains vitamin A, which assists with good vision and is necessary for healthy skin, eyes, bones and teeth; and vitamin D, which is necessary for normal growth as well as healthy bones and teeth.

Materials: Heavy cream, crackers (optional), commercial butter, baby food jars.

1. Fill a baby food jar 1/2 full with heavy cream and tighten the cover. (For quicker results, start with cream and jars at a cool temperature.)

2. Have students take turns shaking the jar vigorously in an up-and-down motion for 25-30 minutes.

3. When all the butter seems to be separated from the liquid, drain off the liquid (buttermilk), and rinse the butter with cold water.

4. Taste it alone or spread it on crackers. Compare it to store-bought butter. (Some of the difference in taste will be the salt that is added to commercial butter.)

Ghost Writing

Key Words: *carbon, compound*

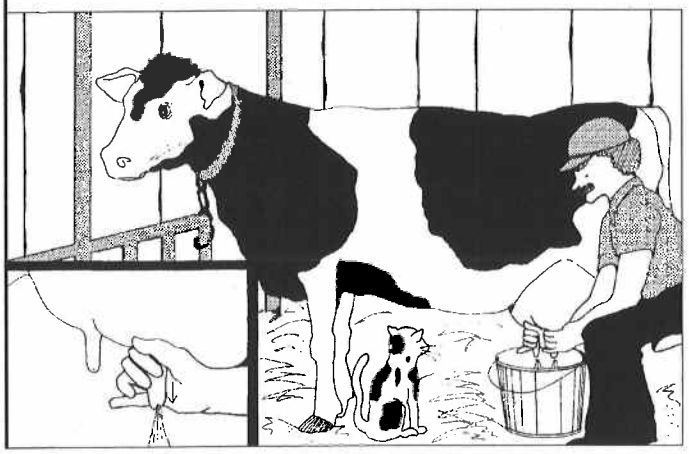
Concept: *Milk contains carbon compounds which turn black when they are heated.*

Create disappearing messages using milk as ink. When dried milk-written messages are heated, the carbon compounds present in milk break down and produce carbon, which is black. (Ghost writing can also be done with lemon, orange, grapefruit and apple juices.)

Materials: Milk, fine brushes, toothpicks or cotton swabs, paper, iron.

1. With a brush, toothpick or swab, write a secret message using milk as the ink. When the "ink" dries, the message will be invisible.

2. Use a hot iron and warm the reverse side of the paper to make the message appear.



Mammal Characteristics

Key Words: *mammal, characteristics, lungs, diaphragm*

Concept: *Mammals have specific characteristics that make them unlike other groups of animals.*

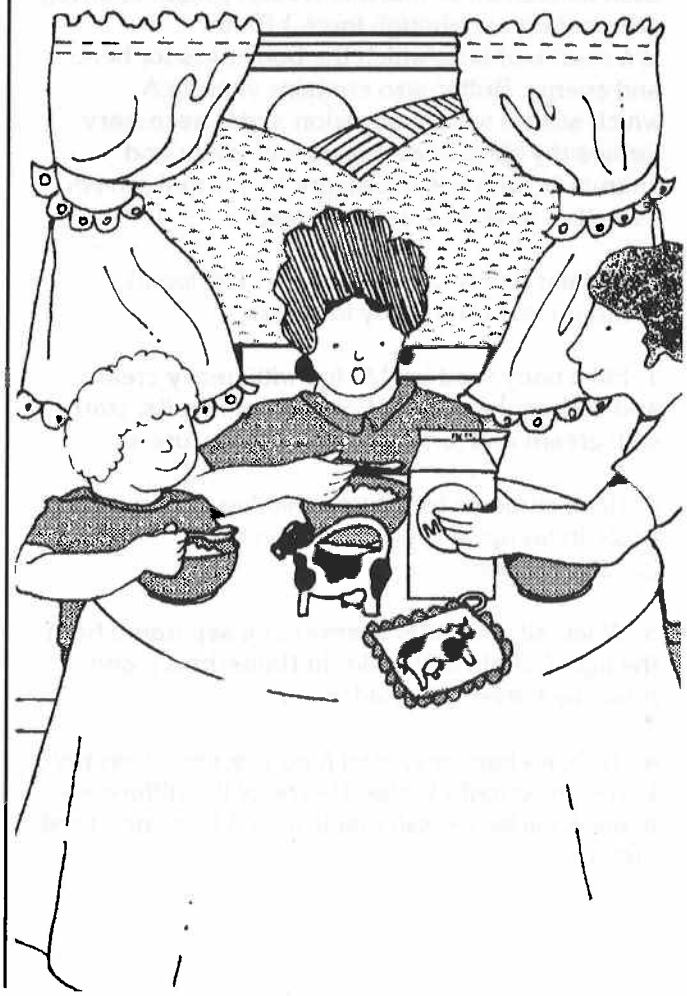
One characteristic of mammals is that they are milk makers. Other characteristics include being warm-blooded and having external ears, a four-chambered heart, hair or fur, and a diaphragm. A diaphragm is a muscular wall between the chest and abdomen that stretches downward to increase the space in the chest for the breathing process. When a mammal breathes, air enters the lungs to fill this space—when exhaling, the diaphragm pushes back up and forces the air out of the lungs.

Materials: Balloons, sturdy 16 oz. plastic soda pop bottles, scissors, tape.

1. Cut the bottom off a plastic bottle. To simulate lungs, place a balloon over the mouth of the bottle and push it down into the bottle.

2. To simulate the diaphragm, cut a second balloon in half (removing the fill hole) and securely tape it to the bottom of the bottle (to cover the area cut off in step 1).

3. Pull down on the diaphragm (the second balloon), and the lungs (the first balloon) will fill with air. Push the diaphragm up and the air is pushed out of the lungs. A spasm (quick jerk) in the diaphragm will make a hiccup. Does this mean that mammals are the only animals that can hiccup?



Mummies Made In Egypt

(GPN # 54)

Author: Aliki
Publisher: HarperCollins

Science Comes Alive
Science Focused

Program Description: Just what is a mummy and where do mummies come from? At the Museum of Fine Arts in Boston we join LeVar to learn about mummies and see how the museum conserves these ancient artifacts. Then, with a closer look through CT scan technology, we discover what's underneath the mummy wrapping and, with the assistance of a forensic artist, what the mummy looked like three to four thousand years ago.

Dry As A Desert Dessert

Key Words: *dry, evaporate, decompose, tissue, preserve*

Concept: *Drying tissue preserves it so it does not decompose as quickly.*

It is thought that the first mummies were created naturally by the drying effects of the desert. The dry heat of the desert evaporated the water quickly from the tissue, so microbes that would usually decompose the tissue did not grow. Egyptians were not the only people to know that drying would preserve things. This same principle is used for making applehead dolls. The apples for these are dried relatively quickly and, while they probably won't last for thousands of years, they will last a long time.

Materials: Small apples, table knife, other safe carving items, cheesecloth (optional).

1. Peel a whole small apple, and use a knife to carve features into the apple. Then put the apple in a warm place — an oven turned on warm is ideal, or a very sunny spot with good air circulation. If the apples are set outside to dry, cheesecloth should be used to protect them from insects and they should be brought in before sunset so they are not moistened by dew.

2. After several hours in the oven (or several days in the sun), the apples will have developed a leathery surface. They will continue drying slowly but can be handled at this point. Simple bodies can be made for the dolls out of paper or cloth.

Science Note: Before refrigeration was available, people often dried food — meat, fish, vegetables, fruits — to preserve and store it for future use. These foods would be eaten in this dry state or rehydrated by adding water.

It's A Wrap

Key Words: *scientists, study, deteriorate*

Concept: *Scientists work to find ways to study things that do not make them deteriorate.*

We depend on our sense of sight to provide information about things. Scientists studying mummies learned that if they unwrapped the mummies to look at them, the mummies would deteriorate more quickly than if they were left wrapped. This meant that new methods of "looking at" mummies had to be found.

Materials: Gauze, cheesecloth or paper towels, several common classroom items.

1. Individually wrap some familiar classroom items in gauze, cheesecloth or paper towels.

2. So they can use visual clues to guess what the items are, show students these wrapped items one at a time. Invite them to use tactile clues to collect additional information.

3. Later, unwrap the items and ask students what clues were the most helpful in guessing the contents.

The Case Of The Mummy Case

Key Words: *symbols, hieroglyphs*

Concept: *Egyptians used symbols called hieroglyphs to write.*

The Egyptians left many clues in the symbols written on the tombs of the mummies. These symbols (hieroglyphs) often told a great deal about the person buried in the tomb, and also about others who had been important to that person — some of whom were still living at the time.

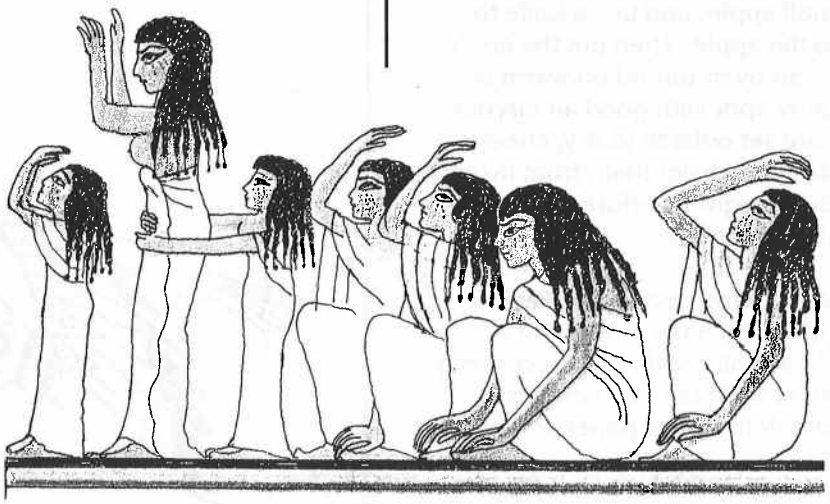
Materials: Pencils, drawing paper, scissors.

1. Draw lines to divide a square piece of paper into nine sections (like a tic-tac-toe game).

2. Cut off the corner squares and discard them (the paper will then resemble a plus [+] sign).

3. Write the name of an object or person lightly in the center square. Fold one flap over the name and write a clue about the object or person on the folded-down flap. Fold the other flaps over, writing clues on the back of each of them as they are folded down.

4. Trade the "wrapped" objects and have students try to guess what is written in the center using the clues one at a time as they "unwrap" it.



Hieroglyphic Writing

Key Words: *symbols, hieroglyphs, cartouche*

Concept: *A person's name can be written using hieroglyphs to form a cartouche.*

Hieroglyphs are symbols used in the writing of ancient Egypt. There are many rules to writing with hieroglyphs. For example, the clues which help determine whether to read the text from right to left, or left to right are the symbols of living things. If animal or people symbols are facing left, then the text is read from the left. Vertical groups of symbols are always read from top to bottom.

A king's name written with hieroglyphs and enclosed in an oval shape is called a cartouche. As a very simplified introduction to the complex world of hieroglyphic writing, use these 24 hieroglyphs to create a cartouche.

Materials: Copies of hieroglyphs and cartouche samples, paper, pencils.

1. Have students compare the symbols in the sample cartouche to the list of hieroglyphs.

2. To create their own cartouche, students need to match the sounds in their names to the hieroglyphic symbols and then write them so they are read from top to bottom, or from the direction that the symbols of living things are facing. If there is no symbol of a living thing, the symbols should be drawn so they are read from right to left since that orientation was generally preferred in hieroglyphic writing.

3. Collect the cartouches and pass them out randomly so students can decipher them and discover whose name they have.

Cartouche for Cleopatra

 = *c*

 = *l*

 = *e*

 = *o*

 = *p*

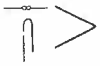
 = *a*

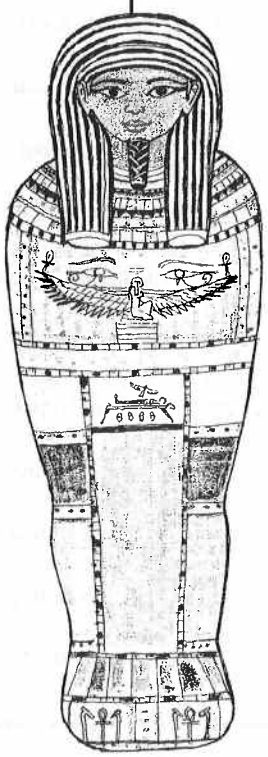
 = *t*

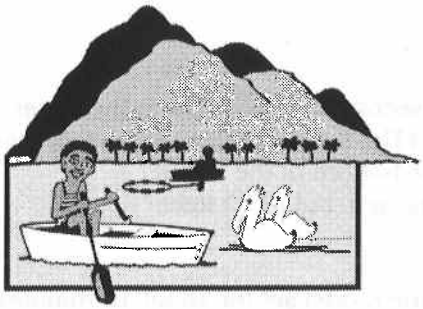
 = *r*

 = *a*

Sign		Sound value
	=	*a* as in ah
	=	*i* as in hit
	=	*ee* as in see
	=	*y* as in you
	=	*a* as in bat
	=	*w* as in will, also *oo* as in move
	=	*b* as in ball
	=	*p* as in pat
	=	*f* as in fat
	=	*m* as in mat
	=	*n* as in nap
	=	*r* as in roll

Sign		Sound value
	=	*h* as in hat
	=	*h* emphatic h as in ha
	=	*ch* as in Scottish loch
	=	*ck* as in lock
	=	*s* as in sat
	=	*sh* as in shop
	=	*qu* as in quilt
	=	*k* as in kit
	=	*g* as in go
	=	*t* as in tap
	=	*ch* as in chair
	=	*d* as in dot
	=	*dj* as in edge





My Little Island

(GPN# 45)

Author: Frané Lessac
Publisher: HarperCollins

Science Comes Alive
Science Connected

Program Description: LeVar tours the beautiful island of Montserrat, which is filled with tropical colors, sights and sounds. The open market has unique flowers, vegetables, fruits, and music. Then he heads for the hills for a "mountain chicken" hunt.

A Little Little Island

Key Words: *island, land forms*

Concept: *An island is a mountain or other piece of land surrounded by water.*

It's easy to think that an island is a clump of land floating on top of the water, but an island is a landmass that juts out of the water. All islands are part of the ocean floor, just as mountains are part of the landscape.

Materials: Oil-based modeling clay, tub, water, blue and green food coloring, paper, pencils, crayons.

1. Have students make a wide, cone-shaped tower from clay for this island model. The tower should be 3 or 4 inches tall.

2. Have them place their cone-shaped tower, which is like a mountain, on the bottom of the tub, which is like the ocean floor. Explain that the bottom of the ocean is not always flat, but that it is like land we see in other places on the Earth—it has valleys and mountains.

3. Have students pour water into the tub until the water is about 2" deep. Color the water with several drops of blue and green food coloring. Ask them to describe their mountain now. (*The mountain is sitting on the ocean floor. The bottom is covered by water, but the top is sticking out above the water—it has become an island.)*

4. Ask students to make a side-view drawing of their island showing how it looks above and below the water level. They can make it a tropical island like Montserrat, by adding tropical plants and animals to their drawing.

(See ***Wrapped In A Blanket Of Water*** next page)

Wrapped In A Blanket Of Water

Key Words: *islands, temperatures, water, air*

Concept: *Ocean water around islands changes temperature very slowly.*

Many Caribbean islands, like Montserrat, have mild warm weather most of the year. One reason the weather stays fairly constant is that the Pacific Ocean, a very large body of water, surrounds the islands. Compared to the changeability of air temperature, ocean temperatures are very stable.

Materials: Clay model of an island in a tub of water (made in the ***A Little Little Island*** activity), two small thermometers, cool area such as a refrigerator or outside on a cold day, modeling clay, craft sticks, paper, and pencils.

1. Use the island model from the activity ***A Little Little Island***, making sure that the water in the model is at room temperature before beginning.

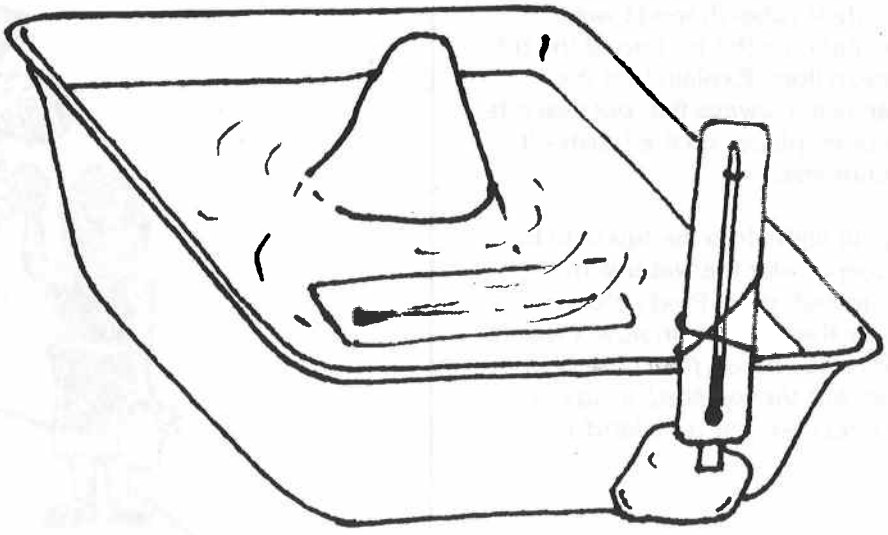
2. Have students place one end of a craft stick into a large piece of clay, and attach the clay to the side of the tub of water. Using a rubber band or more clay, have them attach a thermometer to this craft stick.

3. Submerge a second thermometer in the water near the island. (The thermometer can be attached to the clay at the bottom of the island to keep it submerged, but don't insert it into the clay.)

4. After letting the model set for about 10 minutes, have students record the temperatures on both thermometers. Then place the model in a cool location like a refrigerator or outside on a cold day. Ask students to predict what will happen to the temperatures on each of the two thermometers. Have them chart the temperatures every 10 minutes for an hour.

5. Compare the charted temperatures (the class can create a line graph showing the changes in the two temperatures over time), and discuss the differences. (*The temperature of the water changed much more slowly than the temperature of the air. The same happens with the temperature of the ocean around small Caribbean islands such as Montserrat, it stays warm and changes very little, even over a year's time.*)

6. Ask students what effect such a warm, large body of water might have on the climate of tropical islands. (*It keeps the climate warm and more constant than the climate of a place not surrounded by a large body of water, such as a place far from the ocean.*)



My Shadow

(GPN #109)

Author: Robert Louis Stevenson
Illustrator: Ted Rand
Publisher: Putnam

Science Comes Alive
Science Focused

Program Description: LeVar sheds a little light on shadows as he demonstrates how objects can block light to create shadows. We also learn how shadows can be used to tell time, and even get some fun lessons on the art of creating shadow figures. In addition, a photographer talks about how she uses shadows and the contrast between light and dark in her photographs.

Blur(st) Of Light

Key Words: *light, shadows*

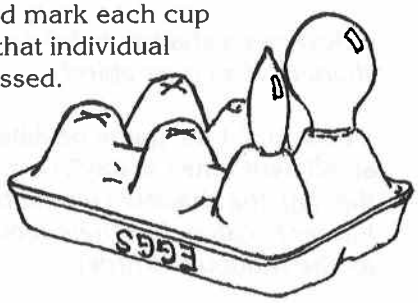
Concept: *Some lights have features to blur shadows.*

Sonny, the shadow artist, needed special know-how to get the shadows just right. He not only had to know just how to shape his hands, but even what kind of light bulb to use. Some light bulbs are better for making shadows than others. In fact many of the lights we use in our homes have special features to blur shadows. Fewer shadows in a room are easier on our eyes.

Materials: Various light bulbs, egg carton, knife, a marker, a smooth surface for casting shadows, lamp, gloves, a lamp shade (optional).

1. Collect between two and six light bulbs. Include at least one bulb that is clear and one that is frosted. You may also want to select bulbs of different sizes, shapes, colors, and wattages.

2. To prepare an egg carton to display the bulbs, use a knife to cut an X in the bottom of several of the individual cups in the egg carton. Then turn the carton upside down and carefully place a bulb in each of the cut egg carton cups. Tape this down to a table and mark each cup with a numeral so that individual bulbs can be discussed.



3. Remind students that shadows are formed when light rays traveling in a straight line are blocked by an object. However, if there is more than one light source or if the light rays from a single source are scattered and reflected by other objects, then the shadows will be fuzzy or blurred, unlike the clear shadows Sonny made. You may want to show students how a lamp shade helps scatter the light coming from the bulb and so decreases the contrast of shadows in the room. Ask students to look at the bulbs and predict which bulb(s) will make the best (clearest or sharpest) shadows and why. After students have had a chance to discuss their predictions, place the bulbs, one at a time, in a lamp. (Be careful to remove hot bulbs with a glove.) Have students decide which bulb(s) makes the best shadows. Can they explain why? (*The bulbs do not scatter the light.*)

Lamp shades and many fixtures around light bulbs help scatter light rays. Ask students to look around the school and at home for light fixtures and devices that are used to change or blur shadows.

Boxing Shadows

(Or, Who Knows? The Shadow Knows!)

Key Words: *light, shadows, shapes*

Concept: *A shadow does not always have the same shape as the object that made it.*

Sonny Fontana used his hand to make shadows, but the shadows didn't look much like hands, they looked like animals and people. Other everyday objects can make shadows that don't look like the objects that made them. Can you guess what an object is by its shadow? Who knows? The Shadow knows.

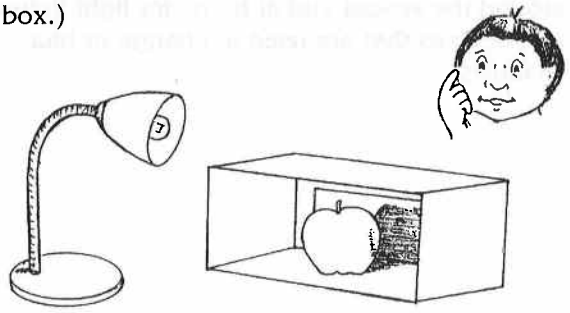
Materials: Shoe box or other similar box, scissors, white typing paper, pencil, tape, several objects small enough to fit inside the box, clay, lamp without a shade, area with dim lighting.

1. To begin making a shadow box, cut a large rectangular opening, about 7" X 10" in the bottom of a shoe box.

2. Tape white typing paper inside the box to cover the rectangular opening you just cut. Make sure that the paper lies flat and there are no gaps between the paper and the box.

3. Collect several common objects that will fit inside the box (cup, toy, rock, comb, toothbrush, etc.). Items that are not symmetrical can make some interesting shadows.

4. Stand the box on a table. Place an object in the box. (You may need to use a small amount of clay on the bottom of the object so it will stand up in the box.)



Darken the room and position a lamp behind the open side of the box so that a shadow is cast by the object onto the paper. Try rotating the object. How does the shadow change? When does the shadow look most like the object? When the least?

5. Position the object so that it makes a shadow that you think is interesting. Ask some friends to look at the shadow but not the object in the box. Have them draw a picture showing what they think is in the box, then show them the object. They may be surprised! You can try it again and again with a different object each time.

Shadow Tag

Key Words: *light, shadows*

Concept: *When an object moves, its shadow moves and changes shape.*

We sometimes talk about shadows as if they were objects like a rock or a cup. This game will help remind you that though we can see shadows they certainly are not like other objects. For one thing, they can be rather difficult to catch.

Materials: Sunny day, several friends, large open area.

Shadow tag is the game of tag adapted to shadow-play. One person is *IT*. *IT* tries to tag another player by stepping on his or her shadow. Once a person is tagged they are *IT*. This game is more difficult than regular tag because shadows can be hard to catch. Before and after the game, discuss the following questions. If students still have trouble answering some of the questions, play the game again or play it at different times of the day.

- What makes a shadow outside during the day? (*light from the sun and solid objects*)
- How can a shadow change? (*e.g. as an object moves the shape of the shadow changes, at different times of day the length of the shadow changes*)
- What about a shadow doesn't change? (*e.g. the direction it points in relation to the sun, it stays one even color*)
- How can a shadow hide? (*e.g. inside the shadow of a larger object*)
- How might the game be different if you played it at different times of day? (*e.g. near the middle of the day, the shadows would be shorter and harder to catch, but there would be fewer places for the shadows to hide*)

In The Dark

Key Words: *light, camera obscura, camera, ray*

Concept: *Light rays travel in straight lines through a pinhole making an upside-down image.*

The first "photographer," a French physicist named Nicephore Niepce, found out that the light coming through a small hole in an outside wall of a dark room would form an upside-down image on the opposite wall. The device he used was called a camera obscura, which means "dark chamber." You could say that the camera obscura is the great grandparent of the camera Andrea Davis used in this episode.

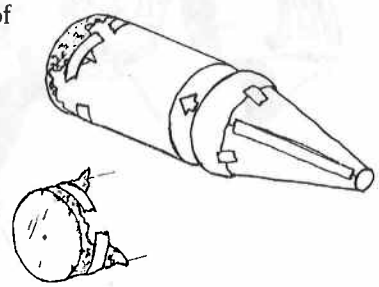
Materials: 12 oz. frozen juice can with both ends removed, black construction paper about 8" x 8", waxed paper, aluminum foil about 5" x 5", tape, scissors, straight pin.

1. Roll a sheet of black paper into a cone shape. Place the wide end of the cone in a juice can and allow the wide end to open until it is the size of the can. While holding it so it keeps its shape, pull the cone out of the can. Adjust the cone slightly by making the wide end just a bit bigger (this way it will fit snugly when back in the can) and the small end about 1/2" in diameter, then tape across the seam of the cone.

2. Using scissors, trim the wide end of the cone so that it is fairly even all the way around. Don't cut much off or the size of your cone will need to be readjusted.

3. Make a waxed paper circle the same size as the wide end of the cone by tracing around the end of the cone. Cut out the circle and tape it to the wide end of the cone keeping the waxed paper flat. This will be your viewing screen.

4. Fold a sheet of foil over one end of the juice can. Tape the foil down to the sides of the can so that it fits tightly and is smooth across the end of the can. Using a straight pin, punch a small hole (1mm) in the center of the foil. This will be the aperture.



5. Place the wide end of the cone in the other end of the juice can.

6. Point the foil end of your camera at a sunlit scene or a bright light. Look through the cone and you will see an image projected on the screen. However, the image will be upside down! This is because the light rays from the top of the image enter through the hole and are focused on the bottom of the screen. The light rays from the bottom of the image are focused on the top of the screen. Try sliding the cone in and out of the can. The image on the screen will get smaller and larger.

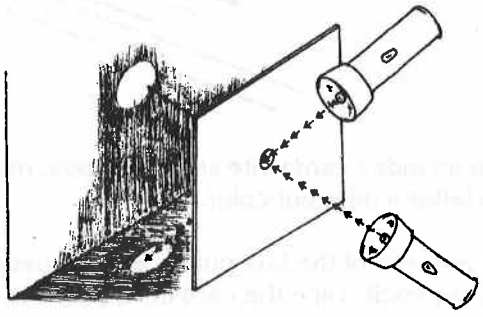
Follow-up Activity

Materials: A flashlight, piece of cardboard (at least 81/2" X 11").

To help understand why the image is upside down, try this activity. In a dimly lit room, shine a flashlight through a hole in a piece of cardboard onto a wall.

Hold the flashlight low and shine it up through the hole, and the beam of light will point upwards behind the hole. This is like the light reflected from the bottom of the image viewed in the camera obscura. This light passes through the hole and hits the top of the viewing screen.

Hold the flashlight high, and the beam of light will point downwards on the other side of the hole. This is like the light from the top of the image that enters the camera and is focused on the bottom of the screen.



Thinking of the flashlight, can you explain why the image on the camera obscura screen gets smaller and larger as you slide the cone in and out? (*After the rays cross at the hole they spread out more and more as they get farther from it.*)

Those Peepers

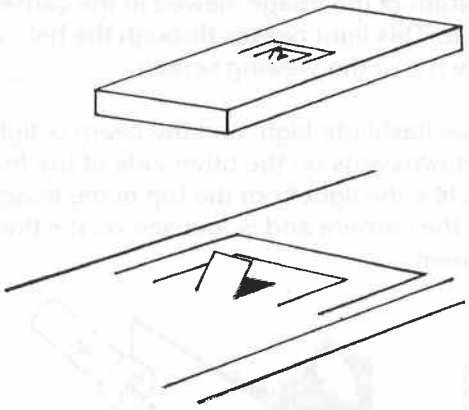
Key Words: *light, camera, aperture*

Concept: *Colors are difficult to see in dim light.*

In this episode photographer Andrea Davis explained that light enters a camera through a special opening called an aperture. The aperture on most cameras can be adjusted to allow in a small amount of light or a large amount.

Materials: Small box with a lid such as a shoe box, pencil, cutting board or newspaper, knife, index cards, markers, tape.

1. Draw a line across the center of a box lid, then draw a square with sides of about 1 cm setting on the line. Around this square, draw two larger squares, one with sides about 3 cm and another with sides about 5 cm (see illustration). Place the lid on a cutting board and cut out three sides of each of the squares. For each square do not cut out the side resting on the line. These square flaps will act as an adjustable aperture. By opening only the small flap you can let in a little light. To let in more light, you can open the second and third flaps.

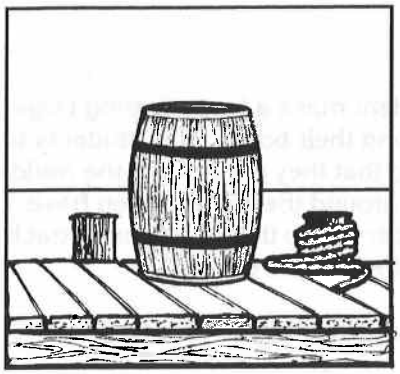


2. On an index card write several letters, making each letter a different color.

3. In one end of the box punch a small peep hole using a pencil. Tape the card inside the box at the other end.

4. Place the lid on the box with all the flaps closed. Look in through the small peep hole. What do you see? *(There is not enough light to read the letters.)* Open the smallest flap. Now what do you see? *(You may be able to see some of the letters but not all depending on their color.)* Try opening the other flaps. Each time you open a larger flap more light is allowed into the box.

5. Show your peep box to a friend and ask them to try to read the letters on the card inside the box and say what color they are. Keep a record of how the amount of light affected which colors were easiest to read. Is it easier for people to read the letters in the middle of the card or those at the edges?



Mystery On The Docks

(GPN # 19)

Author: Thacher Hurd
Publisher: HarperCollins

Science Comes Alive
Science Connected

Program Description: LeVar takes a trip to the docks to find out about "Big Momma Blue," a crane that loads and unloads freighters, and then goes for a spin on a tugboat to see what work they do.

A Big Lift

Key Words: *simple machines, pulleys, cranes*

Concept: *People can lift more weight using a pulley than without one.*

Cranes, like "Big Momma Blue" in the Charleston harbor, are complex machines. Machines are used to make work easier for people. Cranes make work easier for people by using a system of simpler machines like pulleys and cables. Pulleys make work easier by taking some of the weight off the object that is lifted. "Big Momma Blue" is able to lift a load as heavy as 8 elephants by using a system with several pulleys and cables. Discover how a single pulley can be used to make work easier.

Materials: Heavy string, a 1-gallon plastic milk jug with a screw on lid, water, wide tape, red and blue markers.

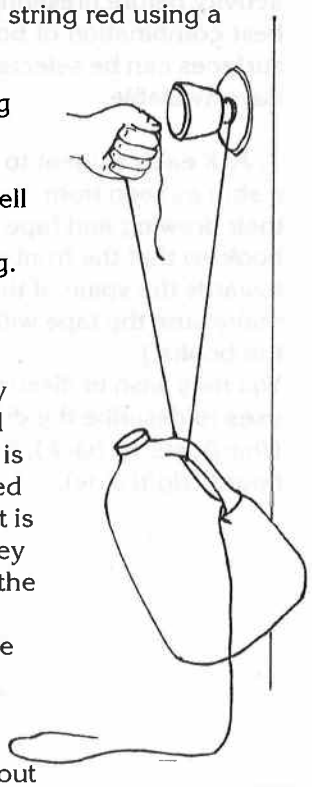
1. Fill the plastic milk jug with water. Place the lid on the jug and tighten securely. Then wrap tape around the lid and the jug to make sure the lid won't fall off if the jug is dropped.

2. Tie a 2-foot piece of string to the handle of the jug. Color the loose end of this string blue using a marker.

3. Ask individual students to lift the jug of water by pulling up on the blue end of the string. Remind them to place the jug back down on the floor as gently as possible. The jug will seem quite heavy and some students may not be able to pick it up using the string.

4. Then explain to the students that they can make the jug easier to lift by using a system that is similar to a pulley and cable. Have a student tie a 6-foot piece of string to a door handle on a strong, solid door. Then ask a students to place the jug of water near the door and thread the loose end of the string through handle of the jug. Color the loose end of this string red using a marker.

5. Have students lift the jug by pulling up on the loose end of the string marked with red. Ask students to tell which of the two strings made it easier to lift the jug. (*The red.*)



The handle of the jug acts similar to a pulley. A pulley that is attached to the load itself, as this handle pulley is attached to the jug, is called a single moveable pulley. It is easy to see why— the pulley moves up and down with the jug rather then being attached to the floor or some other object that can't be moved. By using a single movable pulley, students can lift about twice as much weight as they could without one. The jug is easier to lift using the red string because the pulley handle allows some of the jugs weight to be supported by the door knob.

Tug, Tug, Tugging Along

Key Words: *simple machines, inertia, force, tugboats*

Concept: *It takes more energy to start an object moving than to keep an object moving.*

The "Hinton," a tugboat seen on this episode, demonstrates that although tugboats are small boats, they have very strong engines and can move huge ships many times their own size. One of the hardest parts of a tugboat's job, is in the beginning as it pulls on a ship which is not moving. It takes more force to begin moving an object than it takes to keep an object moving. In this activity you can judge the different amounts of force needed to move a model boat.

Materials: Paper, pencils or crayons, scissors, heavy books, strong string, paper clips, medium strength rubber bands about 2" long, a flat smooth surface.

Teacher Note: To get the best results, try this activity before presenting it to students so that the best combination of books, rubber bands, and surfaces can be selected from the materials you have available.

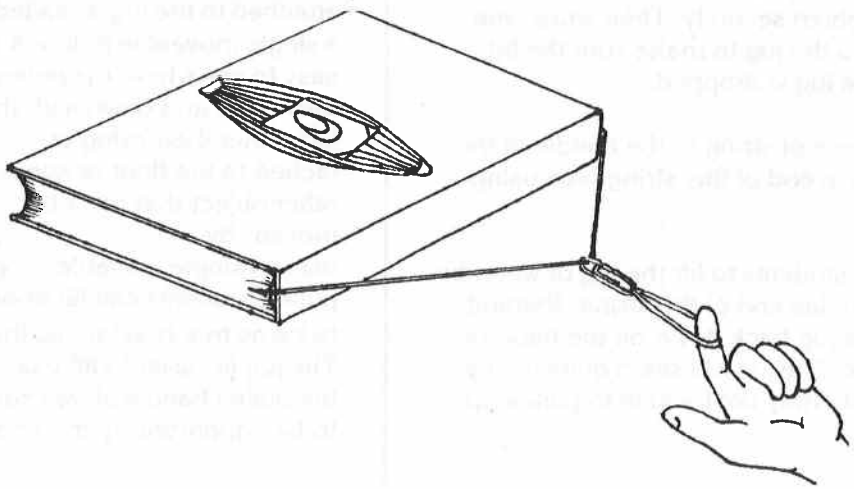
1. Ask each student to make a simple drawing of a ship as seen from above. Have them cut out their drawing and tape it to the top of a heavy book so that the front of the boat is pointing towards the spine of the book. (Check first to make sure the tape will not damage the covers of the books.)
You may wish to discuss the terms Captain Mazeke uses to describe the different parts of a boat: bow (*front*), stern (*back*), port (*left side*), and starboard (*right side*).

2. Have each student make a loop of string large enough to fit around their books. Ask students to place the loops so that they go through the middle of the books and around the spines. Then have them attach a paper clip to their string and attach a rubber band to their paper clip.

3. Have students set their books on a large smooth surface.

4. Ask them to imagine that their book is a docked ship which they are going to slowly move out into the harbor by gently pulling on the rubber band. Tell them to pull on the rubber band using a steady slow movement, not jerky or fast. Explain that the farther the rubber band stretches, the more force they are exerting. Ask them to watch the rubber band closely so that they can tell when the rubber band is stretched the most, indicating when the most force is exerted.

Students will notice that the rubber band stretches the farthest just before the book starts to move. Explain that the amount of force needed to start an object moving is greater than the amount needed to keep an object moving. This is because objects have a tendency to resist changes in motion. This is called inertia. In this case, friction between the book and the table adds to the inertia of the book.



Nosey Mrs. Rat

(GPN # 101)

Author: Jeffrey Allen
Illustrator: James Marshall
Publisher: Viking

Science Comes Alive
Science Connected

Program Description: Being a skilled observer is a valuable tool. Primatologist Dr. Jane Goodall explains how her own curiosity helped her become a leading scientist in the study of primates, and a photographer shows how observation and scrutiny are important in the world of wildlife photography.

A Spy Scope

Key Words: light, mirrors, periscope

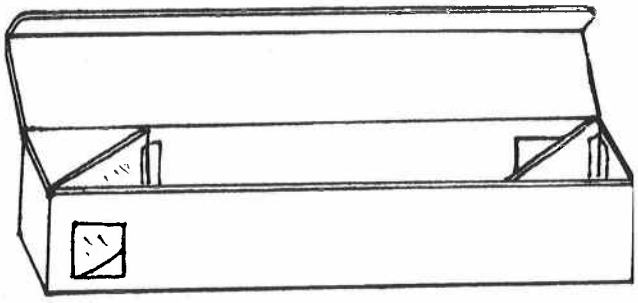
Concept: Mirrors can reflect and change the direction from which we see images.

Nosey Mrs. Rat spent a good deal of time spying on her neighbors. Make a periscope—a piece of equipment that every spy, or nosey neighbor, should have.

Materials: Aluminum foil box or other long narrow box, 2 small mirrors about 2" x 2 1/2", tape, sharp knife.

1. Remove and discard the cutting-edge metal strip from the aluminum foil box.

2. Using a sharp knife, cut a 1" square hole on one side of the box, near the end. Then cut another 1" square hole near the other end on the opposite side of the box as shown below.



3. Close the box and have students look into the box through one of the holes. Ask them to describe what they see. (*The inside of the box.*) Then help the students tape one of the mirrors in the box as shown with the reflective side toward the hole. (Some cardboard can be taped to the back of the mirrors, if they are too small for the box.) Remind students to be careful when handling the mirrors. Close the box again and have the students look through the hole near the mirror. What do they see now? (*Still the inside of the box, but now the other end.*) Help the students understand that what they see has changed because they are now looking at a reflection from the mirror.

4. Have students place the second mirror inside the box with the reflective side toward the hole again. The two mirrors must be at 45° angles as shown. Close the box and have students look through it. What do they see now? (*They can see outside of the box.*) Help the students understand that what they are seeing now is a reflected image coming from the top mirror, down to the bottom mirror, and then out to their eyes. Have students take turns looking over, under, and around different objects. Ask them to predict what part of the room they will be able to see when they look through the periscope. Ask them how a spy or a nosey neighbor like Mrs. Rat could use a periscope? (*They could look at something while hiding behind a wall or a bush.*)

I See And I Think

Key Words: *inferences, observations*

Concept: *We can make inferences based on what we see.*

Mrs. Rat found herself in trouble when she inferred that she would see what was in a neighbor's box by attending his backyard party. She ended up seeing more than she wanted to—like a photograph of herself snooping in someone else's trash. We all have trouble separating what we really see (an observation) from what we think about what we see (an inference).

Materials: Chart paper, markers, brown paper sack, gloves, clean trash items such as empty cartons and boxes, rinsed jars and cans with the labels still on, old magazines and newspapers, broken toys, old clothes, etc.

1. Label one sheet of chart paper "Things We See" and label another sheet "Things We Think."

2. Tell students that a spy, or even a nosey neighbor, must be good at telling the difference between what they really see and what they think. We can usually be sure about the things that we see. If we see a dog we can tell what color it is, whether it is big or small, and whether it has a long tail or a short tail. Things we see are called observations. What we think about the things that we see are called inferences. Inferences are an important part of problem-solving but they are not always right. If we see a dog wagging its tail, we might think that it is a friendly dog. That's an inference. An inference is a guess based on observations. But it would be a good idea to get some more information about the dog before we tried to pet it.

3. Remind the students of the picture of Mrs. Rat looking in a trash can. Ask them why she might be looking in somebody else's trash. (*To find out something about the people who use the trash can, like what they ate.*)

4. Show the students a sack of clean trash. Tell them that you have collected some trash for them to look at and see what they can learn from it. Explain that you will record what they see and what they think about what they see. For example, they may say that they see a jar of baby food so you will write down "a baby food jar" under "Things We See." Then the students may think or infer that there is a baby in the house where the trash came from, so under "Things We Think" you would write "There might be a baby in the house." Remind students that they cannot be certain about what they infer from looking at the trash.

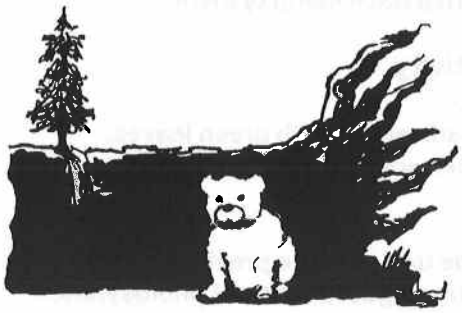
5. While wearing gloves take one item out of the sack at a time. Have the students describe each item and then make any inferences they want to about it. Encourage students to make more than one inference about an item.

Teacher Note: You may wish to have a friend donate the trash. Then you can have the friend read over the list of inferences and let the students know which ones were correct and which were not.

Once There Was A Tree

(GPN #104)

Science Comes Alive
Science Focused



Author: Natalia Romanova
Illustrator: Gennady Spirin
Publisher: Dial

Program Description: Trees serve many roles. They provide oxygen, homes, food, shelter, and shade for people and animals. They also store and recycle water, and help to hold the soil in place. In this show focusing on the importance and beauty of trees, we join LeVar in a forest, visit with a scientist who studies trees, and learn about how sugar is made from LeVar's favorite tree, the sugar maple.

Oxygen Production

Key Words: *trees, plants, gas, air, oxygen, photosynthesis, observations*

Concept: *Green plants give off oxygen.*

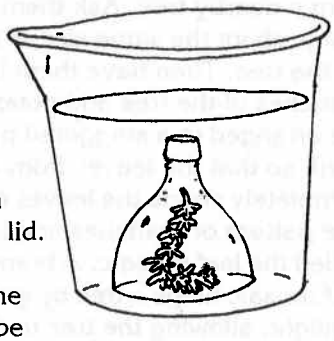
The tree in **Once There Was A Tree** provided food and shelter for many animals. All green plants including trees provide something else important to animals—the oxygen animals breathe. Almost all the free oxygen in the atmosphere is given off by plants. Green plants use energy from the sun to chemically combine carbon dioxide and water to produce glucose and oxygen. Plants use the glucose for food and release the oxygen into the air. This process is called photosynthesis. In this experiment, you can actually see tiny oxygen bubbles created by a plant.

Materials: Clear 2-liter soda bottle with a cap, scissors, a water plant from an aquarium store such as water milfoil or elodea, baking soda, teaspoon, water, a large bucket, bright sunlight or a lamp.

1. Fill a bucket about 3/4 full of water. Add one teaspoon of baking soda for each liter of water in the bucket. The baking soda (bicarbonate of soda) is used as a source of carbon dioxide to speed up the plant's oxygen production.

2. Cut the top half off a 2-liter soda bottle. With the lid off, submerge the top half of the bottle in the bucket of water so that the open top is up. After all the air has escaped from the bottle, place the cap on it.

3. Hold the plant underwater in the bucket and make a fresh cut on the end of the stem. While still underwater, gently shake the plant to release any trapped air bubbles. Then place it in the submerged soda bottle, upside down so the cut end is pointing up and is a few inches from the lid.



4. Look closely at the top of the bottle to be sure there is no air left in the bottle. If there is, remove the bottle cap and replace it again after releasing the air. Then leave the bucket in bright sunlight for several hours. After awhile, tiny bubbles of oxygen will rise from the cut end of the stem.

5. Again look closely at the top of the bottle. The gas that is trapped under the lid is oxygen that the plant released and has accumulated in the bottle. It may be easier to see how much there is if you tilt the bottle to the side so the bubbles move over to the curved part of the bottle.

A Place In The Sun

Key Words: *trees, leaves, area, photosynthesis, leaf mosaic, estimation of large numbers*

Concept: *The green leaves of plants collect sunlight and use it for photosynthesis.*

For almost all trees, the important tasks of sunlight collection and photosynthesis only take place in the green leaves. Although individual leaves may seem small, if you start to add them up you will find that in addition to performing some colossal tasks, their collective size is enormous.

Materials: A broadleaf tree with green leaves, centimeter grid paper, colored pencils.

1. Ask a small group of students to collect a leaf from a nearby tree. Ask them to look for a leaf that is about the same size as most of the leaves on the tree. Then have them look up at the branches of the tree and notice that the branches are arranged in a staggered pattern around the trunk so that the leaves from one branch don't completely shade the leaves on the branch below. The pattern of branches and leaves on a tree is called the leaf mosaic. A branching and staggered leaf mosaic helps a tree by getting more leaves in sunlight, allowing the tree to make more food.

2. Ask the students to lay their leaf down flat on centimeter grid paper and trace around it.

3. Using a colored pencil, have the students shade in all the complete squares in their leaf shape. Ask them to count and record the number of complete squares.

4. Have students look for pairs or groups of remaining incomplete squares, that if combined, would add up to about the same area as a complete square (i.e. two half-squares). As they match up the incomplete squares, ask students to shade them in, and to count and record the number of complete squares made from combining the incomplete squares.

5. Ask the students to add up the total number of squares. This is the approximate area of their leaf—the approximate area for solar collection and photosynthesis production.

Extension: Have students compare the areas of leaves from different trees. Remind students that pine needles are also leaves. Ask them to speculate how evergreen trees make up for having such small leaves? *(They have many of them.)*

Follow-up Activity

Materials: A broadleaf tree with green leaves, pencils, grid paper, scissors, newspaper, a large open area.

1. Using the same tree as in the previous activity, ask students to try to guess the total photosynthesis production area for the tree (the total surface area of all the leaves on the tree). Would all the leaves on the tree cover a desk, a classroom, a gym, a football field?

2. Have students examine a large, low-hanging branch on the tree and count the number of leaves on a small part of the branch. Then ask them to estimate the number of leaves on the whole branch and write the number down.

3. Ask students to stand back from the tree and count or estimate the number of large branches. Have them (or help them to) multiply the number of branches times the number of leaves on the low-hanging branch. This will give them the approximate number of leaves on the tree.

4. Ask students to cut out several rectangles of grid paper that have as many squares as their leaf did in the previous activity. Then have the students lay these out on a sheet of newspaper to find out how many leaves would cover approximately the same area as a large sheet of newspaper. Help students divide the number of leaves on their tree by the number of leaves that fit on a sheet of newspaper. This number is the total number of sheets of newspaper equal to the area covered by leaves on their tree.

5. In a large open area, have students lay out the total number of sheets of newspaper equal to the area covered by leaves on their tree.

A Room With A View

Key Words: *tree, making a model, tree house, trial and error problem solving, cooperation*

Concept: *Careful planning improves the final product.*

There is something very appealing about a tree house; they are secluded, have good circulation of air, and best of all, they have a great view. Still, they can be very difficult to build. A good tree house must be safe and should not harm the tree in which it is built. The tree house used by scientist Meg Lowman was made after some very thoughtful planning. How would you make a tree house that was safe for you and for the tree?

Materials: Paper, pencils, small tree branches, buckets filled with gravel or sand, arts and craft supplies such as ice-cream sticks, pipe cleaners, string, and glue.

1. Ask pairs or small groups of students to select a small fallen branch for use as a model for a tree. Ask them to try to find one with several smaller branches on it so it looks a bit like a tree. Have students stand their branch up in a bucket filled with gravel and pretend that this is the tree in which they want to build a tree house.

2. Looking at their "tree," ask students to decide where in the tree they would build a tree house. Then have them make a drawing showing the shape and size of their tree house and its position in the tree. Ask them to plan ways to make their tree house safe. How will they make it sturdy, yet not too heavy for the branches? How will they make it open so the wind will not blow it down, yet not so open that you may fall out? How can they attach it to the tree without damaging the tree and leaving it open to infection? And of course they will need to plan a way to safely get up into and out of their tree house, even if the weather turns bad while they are in it.

3. After completing their drawing, have them collect materials and begin construction on the model. They may find that they have to alter their drawing to make use of available materials or to overcome a design flaw. Don't let that slow them down. Part of making a model is overcoming obstacles.

4. Have students share their drawing and model tree house with a classmate. Students should explain the safety features of their tree house and give examples of how it was constructed to coexist with the tree. Ask students to tell how they might change their design if they had the chance to really make the tree house.

Moving On Up

Key Words: *plants, water, transportation, recording, comparing*

Concept: *Plants take in water at the roots and move it up through the trunk and branches to the leaves.*

Trees take in water through their roots and transport the water up through the trunk and branches to the leaves, where the water is used in the process of photosynthesis. The leaves use the water and sunlight to produce glucose which is then transported back through the tree as food.

Materials: Celery stalks with leaves, food coloring, water, plastic cups, paper, crayons.

1. Fill three plastic cups about 2/3 full of water. So you can compare different color changes, add 10 drops of red food coloring to one cup and 10 drops of blue food coloring to another cup. Do not add food coloring to the water in the third cup.

2. Place a stalk of celery in each cup. Then using crayons draw a picture of the celery. The celery in each cup should appear to be about the same color.

3. Leave the celery in the cups overnight. The next day compare the three stalks of celery. You will see some definite color changes in the celery from the cups of colored water. Hold the stalk from the cup of plain water next to the other two celery stalks. What parts of the celery have changed color the most? (*leaves*)

4. Make another picture recording the color changes of the celery. On your picture draw arrows to show the movement of the water from the cup up through the celery stalk and into the celery leaves.

Science Note: Many people refer to celery stalk as the stem of the plant. It is actually a part of the plant called the petiole, which is the part that connects the leaf to the stem. The stem of a celery plant is very short, but the petioles are very long.

That Special Something

Key Words: *trees, bark, senses, touch, using observations, cooperation*

Concept: *Every tree is unique.*

Trees can be thought of as pretty much all having certain parts. They all have a trunk, branches, leaves of some kind, roots, bark, and so on. When LeVar talked about his favorite tree, the sugar maple, he was referring to a specific kind or species of tree. Trees that are the same kind have parts that are the same in some way. The leaves are usually the easiest way to identify what species a tree is. Yet, even among trees of the same species, every individual tree is different. This can be seen as well as felt!

Materials: Blindfolds (1 for each team of 2-3 students), area with several trees that can be approached easily without damaging plants below them (e.g. not with flowers planted all around)- check to make sure that there are not harmful plants nearby trees (e.g. poison ivy, green cat briar).

1. Teach the students how to safely lead a person who is wearing a blindfold. The person being led can grasp the leader's left elbow with her or his right hand (or vice versa). The leader still has both hands free but the person being led can be close and feel the leader's movements. Also, talk to the students about watching for hazards such as low branches, things to step over, and so on. Be sure to emphasize that the leader must be trustworthy and responsible.

2. Review with the students the procedures for being safe outdoors (see **The Salamander Room** activity ***Right At Home.***) Point out any trees that are off limits due to having hazardous or delicate plants around them.

3. Have one member of each team of students wear a blindfold. The other member(s) choose a tree in the assigned area. The blindfolded person can be led to this tree along a circuitous route, and maybe even with a little spinning here and there, so they do not know for certain where the tree is.

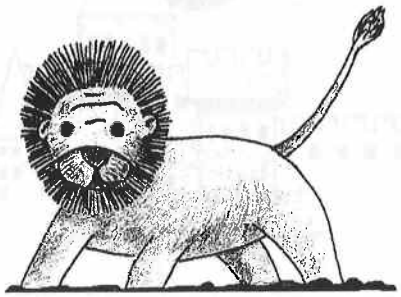
4. The blindfolded person can feel the tree from the base to as high as she or he can reach while imagining what the tree looks like. The ground around the tree can also be felt for clues. What are the textures, shapes, and other characteristics that might help identify the tree?

5. The team should return, again by a circuitous route, to the starting point. The blindfolded person can remove the blindfold and begin looking for the tree. What are the features of that tree that make it special and unique?

6. Have team members exchange roles and try the activity again.

Opt: An Illusionary Tale

(GPN # 76)



Author: Arline and Joseph Baum
Publisher: Viking Children's Books

Science Focused

Program Description: How are illusions created? LeVar helps demystify illusions as he shows how a special effects shot is created for television and then — with the help of special effects technology — enters the pages of the feature book to explore how these optical illusions occur. An illusion of another sort is created by a talented painter, who specializes in art that tricks the eye.

Putting The Hole Thing Together

Key Words: *image, three-dimensional*

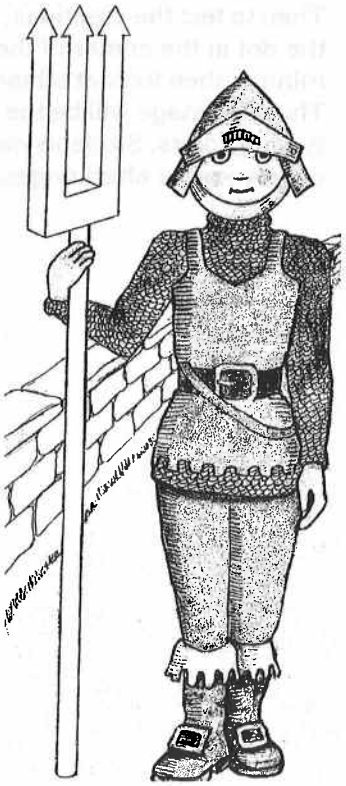
Concept: *Objects look three-dimensional due to the combination of the images from our two eyes.*

An image that we see is actually two images put together. Each eye sees a slightly different view and the brain puts them together. It is this combined image that makes things look three-dimensional rather than flat.

Materials: Pencils, paper.

1. To demonstrate that each eye sees a different view, ask each student to hold a pencil out at arm's length. Have them look at the pencil point with one eye (close the other eye) and then with the other. They will see that the pencil seems to move when they switch eyes. This is because each eye is seeing the pencil at a slightly different angle and the change they see is a shift in the background. This difference is even more obvious if they try the same activity with the pencil closer to the nose.

2. To explore how two images combine to create one view, have each student use a paper several inches long to shape a one-inch diameter tube. Have them hold out their right hand with their fingers pointing up and the palm away. Next have them place the middle of the tube between the thumb and first finger of that hand, gently pressing the thumb against the tube to hold it in place. Now move the tube (and hand) up to the left eye. Keeping both eyes open, look through the tube with the left eye while looking at the back of the hand with the right eye. The image of the hole in the tube will combine with the image of the hand to give the appearance that there is a hole in the hand.



Hurray for the Green, Black, and Orange

Key Words: *afterimage, illusion, complementary color*

Concept: *Staring at colors then looking at something white causes an after image in the complementary colors of the image.*

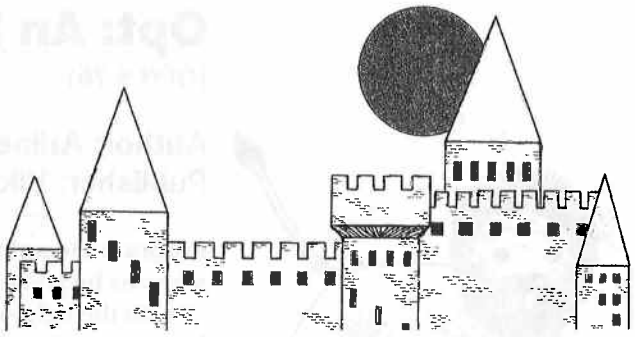
Using the afterimage effect introduced in the feature book (changing the balloon from red to green), you can create your own illusions.

Materials: Paper, opaque paints or magic markers, pencils.

1. To begin the process of creating an after-image illusion, ask each student to think of something that is known by its shape and color arrangement (e.g., stop signs, school crossing signs, traffic signals, fruits, flags, etc.). Have them choose one and make a pencil drawing of it.

2. Using a color wheel as a guide, have students color the picture using complementary colors in exchange for the typical colors (i.e., switch red with green, yellow with violet, blue with orange, and white with black).

3. Place a black dot near the center of the picture. Then to test the creations, have students stare at the dot in the center of their picture for one minute, then look at a blank piece of white paper. The afterimage will be the image of the object in its typical colors. Students can trade drawings and observe other afterimages.



Watch the Birdie, Catch the Birdie

Key Words: *persistence of vision*

Concept: *Persistence of vision causes quickly-changing images to overlap.*

The phenomenon of persistence-of-vision is similar to afterimage because it is a result of a mesh of individual visual images that are held briefly in our brain. Persistence-of-vision allows the images to be put together in a steady flow. This phenomenon makes it possible for us to see a movie as continuous movement when it is actually a series of single still images moving quickly in front of our eyes.

Materials: 3 x 5 cards, black felt tip pens (narrow tip), tape, unsharpened pencils.

1. To mark the center of a 3 x 5 card, fold it in half so it is divided into two 3 x 2.5 inch sections. Unfold the card, place an unsharpened pencil on the fold so the eraser is at the top and tape the pencil to the card.

2. In the center of the right side of the card, draw a small bird with a black felt tip pen.

3. Turn the card over so the pencil (with eraser at the top) is underneath the card. In the center of the side that is now on the right, use a felt tip to draw an empty bird cage large enough to hold the bird drawn in the previous step.

4. Pick the card/pencil up and hold the pencil between the palms of both hands. Roll the pencil back and forth while watching the right side of the card. Because the image of both the bird and the cage persist momentarily, they seem to overlap and the bird appears to be in the cage.

Mirror

Key Words: *lines of symmetry, reflection*

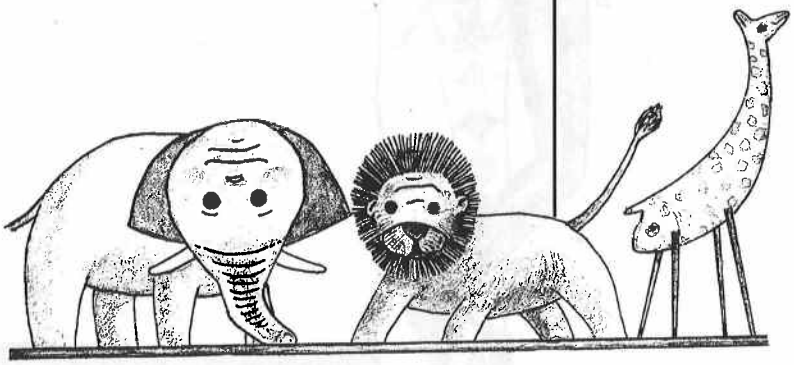
Concept: *Mirrors create a line of symmetry between the real image and reflected image.*

We depend on information from our eyes to guide our movements. As we've witnessed in the previous activities, sometimes our eyes can play tricks on us. Other times our eyes don't have to play tricks to make simple things tricky. For example, writing our name, even with closed eyes, is usually easy. But try to do it by looking in a mirror. Our eyes see a clear reflection, and our hand knows what to do, but they don't seem to work very well together.

Materials: Small rectangular or square-shaped mirrors, paper, pencils.

• Working together in teams of three, have students take turns writing their names while looking in a mirror. One of the group members can hold a piece of paper or lightweight cardboard under the writer's chin so the writer can only rely on the image in the mirror as a guide. The third group member can hold the mirror in place for the writer. Have group members trade positions.

• Have students use a mirror to find lines of symmetry for each letter of the alphabet. (A line of symmetry is any line that cuts a letter or picture, so that the reflection looks like the missing part.) Students can begin their survey by placing the mirror at a right angle to each letter so it is cut in half. Which letters have vertical lines of symmetry? Which have horizontal lines? Which have several lines of symmetry? Is there a difference between printed and written letters?



Cross Multipl-eyed

To focus on any object our eyes must be pointed directly at it. Because our eyes are set apart, they angle toward each other as we focus on an object. The degree of this angle changes as the object moves closer or farther away.

Materials: White paper, 3 x 5 cards, pencils.

1. In pairs, partners can take a turn watching the eyes of others as they focus on their fingertip and move their hand up to and away from their nose. As the finger gets closer, the eyes will point toward the bridge of the nose.

2. At arm's length, hold out hands so the index fingers are pointing towards each other — tip to tip but not quite touching. Focus on a spot on a wall that is several feet away. Next move fingers to about 12 inches from the eyes (this will block the view of the spot). A little sausage-shaped object floating between the fingers will appear. Actually, the object is an illusion created by the overlapping images of the finger tips that each eye sees.

3. Overlapping images can lead to some other interesting effects. On the right side of a 3 x 5 card, draw a 1/2-inch dark silhouette of an airplane as it would look from above. At no more than an inch to the left of the plane draw a 2-inch square landscape (including such things as a river, a bridge, a road, a pond, trees, a house, etc.) as it would appear from above. When it's complete, focus on something that is several feet away and without changing this focus, move the card so that it is about 6 inches in front of your eyes. It will appear as though the airplane is flying over the landscape. Pivot the card so the right side moves up and down and the plane looks like it is really flying.

Is It Hot or Not

Key Words: *senses, touch, temperature*

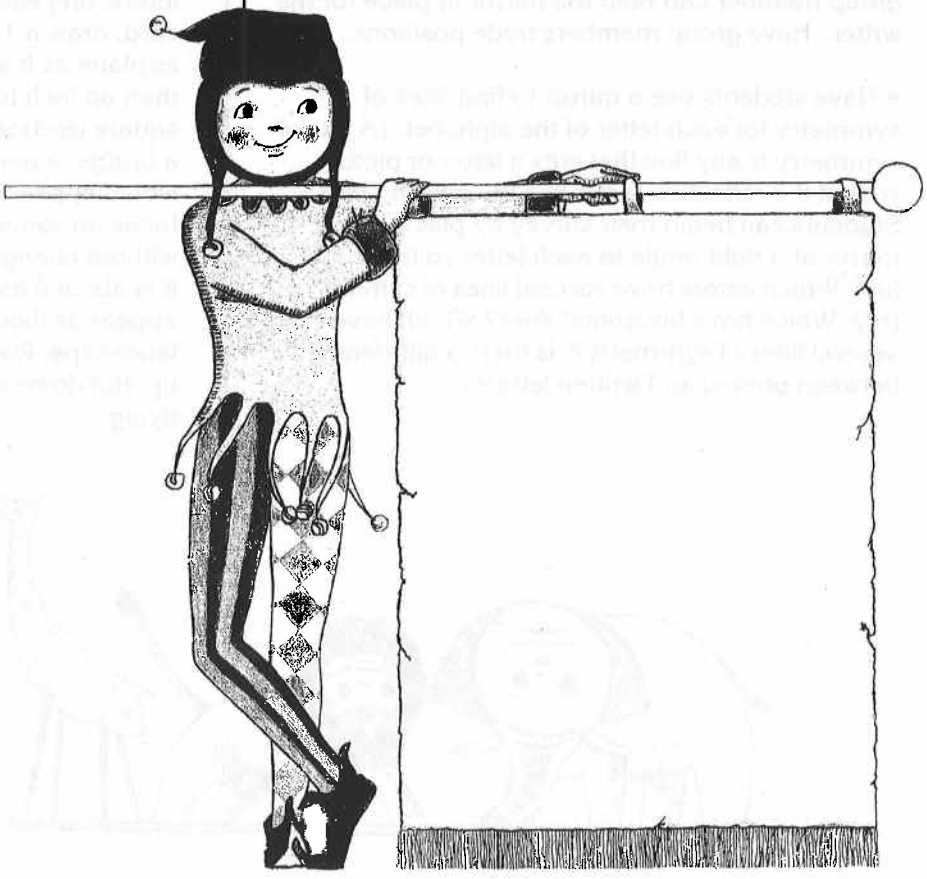
Concept: *Our sense of touch, like the sense of sight, can be misled in some ways.*

Our eyes aren't the only way we can experience sensory illusions. Each of our senses can be misled if the conditions are right. For instance, our sense of touch can be misled in judging temperature. Our perception of a hot day will vary depending on whether we step outside from an air-conditioned building or a warm building.

Materials: Three basins, cold water, room temperature water.

1. Fill three basins with water — two with room temperature water and the third with cold water.

2. Have several students place one hand in the basin of cold water for two or three minutes. Then have them put one hand in each of the two basins of room temperature water. Ask them to describe the temperature of the water in each basin. *(They will indicate that one basin is warmer than the other. The hand that was in the cold water will perceive the room temperature water as warmer.)*



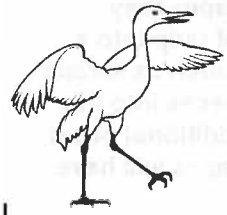
The Paper Crane

(GPN # 39)

Author: Molly Bang
Publisher: Greenwillow

Science Comes Alive
Science Connected

Program Description: LeVar celebrates Japanese culture as he explores the artistry of Japanese vegetable carving, the art of origami, and joins Soh Daiko, an energetic and colorful group of Japanese drummers and dancers, to perform the celebratory "festival of the drums." The episode also includes an artist who shows how she makes paper from old blue jeans.



Paper Cookies

Key Words: *paper, cellulose fibers*

Concept: *Paper is made from plant fibers, which can be recycled and used again and again.*

Making paper from natural plant fibers is a very old process that originated in China (about 100 A.D.). The idea of reusing or recycling materials to make paper is as old as paper making. The first paper was made from mulberry bark, scraps of old linen cloth, hemp, and old fishing nets (all of these are plant products).
In this episode, Linda Forgach made paper from old cotton jeans. Recycling works well for paper because paper is made from cellulose plant fibers that can be used and reformed into sheets of paper again and again. Now try making new paper from old paper scraps.

Materials: scraps of construction paper, magnifying glass, water, bowl, electric blender, plate, small milk carton or other small container, fiberglass window screen, embroidery hoops (larger than a coffee can lid), coffee can, cookie cutters (the kind that are open on both top and bottom), newspapers, paper towels, tray, books.

1. Have students tear collected scraps of paper into pieces smaller than 1" and place them in a bowl. (The paper can be sorted by color or mixed all together.) Ask students to hold up a scrap of paper and look closely at the torn edge with a magnifying glass (or microscope). Explain to students that the tiny threads they see are the cellulose plant fibers that are used to make paper. To make new paper the plant fibers must be separated from each other and then rearranged to form a new sheet of paper.

2. Add water to the bowl of paper scraps and leave them to soak overnight.

3. The next day, pour 4 cups of water and about 1/4 cup of the soaked paper pieces into an electric blender. Blend until the paper is completely broken up. (Don't be tempted to add more paper. You could burn out the blender motor.) This is your paper pulp. Pour a small amount of the pulp out onto a plate. Have the students look and feel the paper fibers. Explain that the blender has separated the cellulose fibers from each other.

4. Stretch fiberglass screen across an embroidery hoop by stretching the screen across the inner ring and fitting the outer ring over it to hold the screen securely in place, just as you would with fabric. Trim extra screen from the edges and place the screen-covered hoop over the open end of a coffee can.

5. Pour about 1/3 cup of the paper pulp into a small, clean, milk carton. Have a student place a cookie cutter on top of the screen and slowly pour the pulp from the milk carton into the cookie cutter. Ask the student to completely cover the inside shape of the cookie cutter with not more than 1/4" of pulp. Give the water a moment to drain from the pulp and then have the student remove the cookie cutter leaving a pulp shape on the screen.

6. Ask the student to turn the screen with the pulp shape over onto a stack of newspapers. Then have the student absorb some of the water by lightly pressing straight down on the back of the

(Continued)

screen with a paper towel. This will also help to press the pulp shape onto the newspaper. Next ask the student to slowly pick up the screen in a rolling motion, watching that the pulp shape sticks to the newspaper. After several students have placed shapes on the newspaper, cover them with dry newspapers, a flat tray, and several books. After about 15 minutes, remove the shapes and place them onto dry newspapers to finish air drying.

7. When students have mastered the technique, they can add some variety to the shapes they make by pouring a very thin layer of pulp into a cookie cutter and then laying items such as scraps of yarn, paper dots, or torn paper pieces into the cookie cutters and finally pouring additional paper pulp over the items. The finished shapes will have the items embedded in them.

Paper Testing

Key words: *paper, making comparisons, measurement, function and properties*

Concept: *Different papers have different qualities.*

Although all paper is made from cellulose plant fibers, all paper is not alike. Cellulose fibers from different plants produce different kinds of paper and even paper made from the same kind of plant can be very different because of differences in how the paper was made and dried.

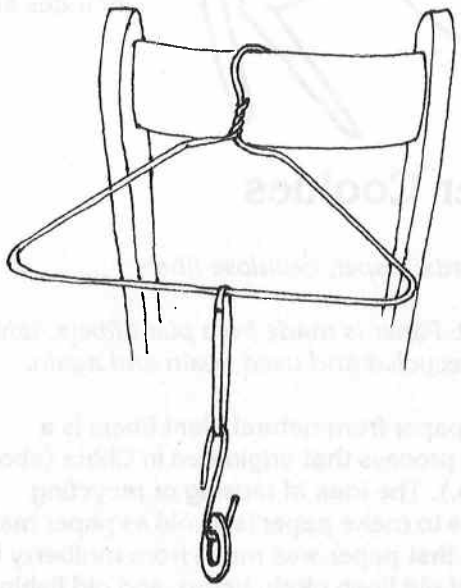
Materials: Different kinds of paper cut into 1/4" x 6" strips (i.e. construction paper, brown grocery sack paper, origami paper, typing paper, toilet paper, paper towel, newspaper), large paper clips, tape, wire clothes hanger, heavy washers, paper, pencil.

1.Give each group of students one strip of each kind of paper, a hanger, a paper clip, some tape, and some washers. Ask students to describe each kind of paper and talk to the students about what each kind of paper is used for. Ask them to predict which is the strongest. Be sure that students can identify each kind of paper by name. Choosing papers of different colors (as well as different types) will help young students identify them. You may need to make a key on a bulletin board showing each type of paper and its name.

2. Have students hang their hanger from a door knob or the back of a chair.

3. Then ask students to tape the ends of one of their paper strips together to make a loop around the bottom wire of the hanger.

4. Have them pull out and down the center wire of a paper clip to make a hook and place this hook through the bottom of the paper loop.



5. Ask students to slowly place washers one at a time onto the hook until the paper breaks. Then have them record the type of paper and the number of washers it took to break the paper.

6. Havestudents repeat the process for each type of paper. Ask them to keep a record of their findings.

7. Ask students to make a chart showing the papers in order from the weakest to the strongest. Each group can share their findings with the class and discuss similarities and differences between their findings and the findings of other groups. Ask students to explain how the strengths of the papers might relate to their uses. (*e.g. Paper towels do not have to be strong, but they do need to be absorbent. Newsprint must be strong enough to go through a printing press, but also light weight. Origami paper needs to be thin and yet strong enough to be folded many times and not tear.*)

The Patchwork Quilt

(GPN # 22)

Author: Valerie Flournoy
Illustrator: Jerry Pinkney
Publisher: Dial

Science Comes Alive
Science Connected

Program Description: LeVar visits the Boston Children's Museum where he discovers kids making their own brightly colored patchwork quilt pieces. He also explores how three generations of an Italian American family work together in their food store, and gets a lesson in making the store specialties—fresh mozzarella cheese and meatballs.

Fabulous Fabrics

Key Words: *fabrics, observations, senses, textures*

Concept: *Fabrics have many different characteristics.*

In the book *The Patchwork Quilt*, Grandma carefully collected samples of fabric that reminded her of people and events. Her family was also able to recognize individual quilt pieces in the completed quilt. Fabrics have many different characteristics such as color, pattern, texture, and weight. Consider what fabrics, based on their characteristics, are good for making a rag doll.

Materials: Clean fabric scraps in a variety of colors and textures that have been cut into squares that are about 8" x 8", hand lenses, chart paper, yarn or string, scissors, cotton balls, markers, pre-made sample rag doll (see last step for directions).

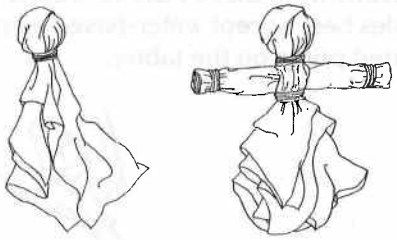
1. Give each group of students a collection of fabric samples, which includes at least 3 samples for each student. Some of the samples can be from the same fabric.

2. Ask them to name ways their fabric samples are different. Record their responses on chart paper. At first they may focus on differences in color or pattern. Encourage them to touch the fabrics to discover characteristics like texture, weight, ability to stretch and to allow light through.

3. Give them hand lenses and ask them to look at ways the threads or fibers in the fabrics are different. These might include size, weave, texture, and number. Record these on the chart.

4. Show students the rag doll, and discuss with them the fact that people have been using scraps of fabric to make rag dolls, like they've made patchwork quilts, for many years. In this activity they will have a chance to make a rag doll which they can keep or give as a gift.

5. Have students select two fabric samples for their doll. Encourage them to think about all the ways the fabrics are different as they make their selection.



6. Have them follow these steps for making their rag doll:

- ***Head:*** place three cotton balls in the center of an 8" x 8" piece of fabric and fold the fabric up around the cotton balls. Tie yarn around the fabric to make a neck.
- ***Arms:*** fold another piece of 8" x 8" fabric in half. Roll up the fabric starting at one of the smaller ends. Tie yarn around both ends of the fabric roll. (If the fabric is thick, cut it in half to make a 4" x 8" rectangle, and roll up one of the halves to make an 8" long fabric roll for the arms.)
- ***Body:*** gather the fabric under the doll's head into two narrow bunches. Center the arms under the doll's neck between the two bunches of gathered fabric. Pull the gathered fabric down over the arms, then tie yarn around the fabric to hold the arms in place and to make the doll's waist.

Use markers to draw the face and for other details.

Extension: Students can use fabric scraps to make hats, aprons, vests, etc. for their dolls.

Getting the Paint In

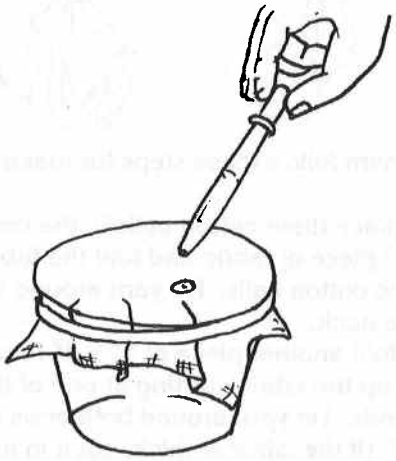
Key Words: *fabrics, absorption, water*

Concept: *Fabrics absorb water at different rates.*

Fabrics can vary in many ways—texture, weight, colors, patterns. Another way fabrics vary is by their ability to absorb water. Cotton is very water absorbent, while nylon is not. The type of fabric, the tightness of the weave, and the texture determine how well a fabric will take in a water-based dye. One reason cotton fabrics come in so many wonderful colors, is that cotton accepts dye well.

Materials: Scraps of solid colored fabrics in a variety of textures and weights, plastic cups, rubber bands, eye droppers, stop watches or watches with a second hand, paper and pencils, water-based tempera paint, shallow bowls, sponges, potatoes, table knives, newspapers, paper towels.

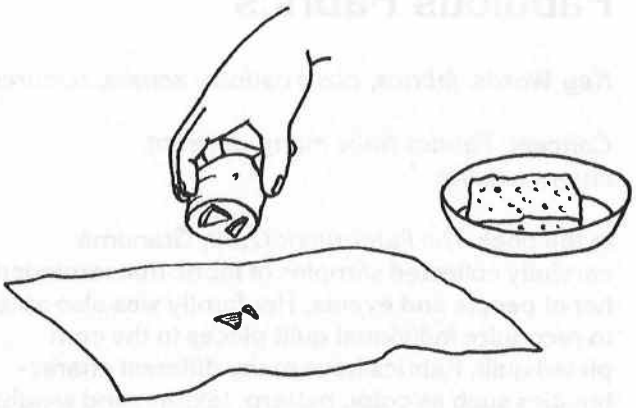
1. Give small groups of students several fabric samples to test for water absorbency. They will use the results from these tests to predict which samples best accept water-based paint for making repeated prints on the fabric.



2. Have students place one of the samples over the top of a cup and secure it with a rubber band. Using an eyedropper, have them place a drop of water on the cloth and time how long it takes for the water to be absorbed into the fabric. After they record a description of this fabric and the absorption time, and have them repeat the procedure for each of their fabric samples. (*Fabrics that quickly absorb water are called hydrophilic meaning water loving. Fabrics that repeal water are hydrophobic or water hating.*)

3. Based on their absorption data, have students make predictions about which fabrics will work well for printing. Ask them to sequence the fabrics from best to worst. Are there any similar characteristics among the absorbent fabric? Among the non-absorbent fabrics? Does it seem to matter whether the fabrics are old or new? (*New fabrics are treated to make them water and stain resistant. Washing removes this treatment.*)

4. Have students create a potato stamp by cutting the end off potatoes, and cutting a design into the flat, smooth surface.



5. Create prints by pressing the potato stamp onto a paint-soaked sponge, and pressing the stamp onto the fabric. Have them try stamping the fabric several times. Does the fabric absorb the paint well? Was their prediction correct? Have them do this on all their samples. Then have them select a fabric that accepts the paint well and use the stamp to make a patterned cloth for display.

Paul Bunyan

(GPN #21)

Retold by: Steven Kellogg
Publisher: Morrow

Science Comes Alive
Science Connected

Program Description: LeVar joins Smokey Bear for a trip to Maine, the legendary birthplace of Paul Bunyan, where he takes part in forest firefighter training. He also visits a reforestation area and finds out how little seeds become big trees, as well as why planting and caring for trees is important.

Class Tree Year Book

Key Words: *trees, measurement*

Concept: *Trees have characteristics that can be described.*

The fictional character, Paul Bunyan, was an extraordinary lumberjack who spent most of his time in the forest. To be a lumberjack you need to enjoy being outdoors around trees. Take a year and get to know a tree.

Materials: Area with trees, notebook, pencils, measuring tape, crayons, tape, aluminum foil, tree resource book.

1. Have students choose a tree to observe for the next year. Create a class tree journal and, working together, have students record as much information as they can about the tree including:

- The measurement of the tree's circumference.
- An estimate of the tree's height.
- A map showing the location of the tree.
- An impression of the bark using aluminum foil (tape it into the notebook).
- The type of tree and general information about it (use a tree resource book).

2. Have pairs of students take turns making monthly journal entries describing the tree. Ask them to include the following in each journal entry:

- The date, the season, and a description of weather.
- A drawing of how the tree looks this month (to show the branches, the shape, and whether it has leaves or not)—and a tracing or rubbing of a leaf (to show the shape and size if it has leaves during this season).
- A description of the area around the tree including other living things near it such as mosses, fungi, lichens, grasses, plants, etc.
- A prediction of what the tree will look like next month.

Students will observe more changes in the appearance if they choose a deciduous tree. If they choose a coniferous tree or other plant, they will see changes in the weather, animals, and the plant as it bears fruit or produces seeds.

Tree Cookies

Key Words: *trees, growth rings, bark, wood*

Concept: *You can tell the age of a tree by counting its growth rings.*

In this episode LeVar tried his hand at sawing a log in a lumberjack contest. Thin slices sawed off the end of a log are sometimes called tree cookies. Use tree cookies for dendrochronology, the study of tree rings.

Materials: Tree cookies (thin slices of wood from a tree trunk or large branch; ask a Christmas tree farm for pieces cut off the ends of tree trunks or ask parents to cut thin slices from recently cut fire wood), pencils, index cards.

1. Give each small group a tree cookie. Ask students to describe their cookie by telling about its size, color, shape, and smell.

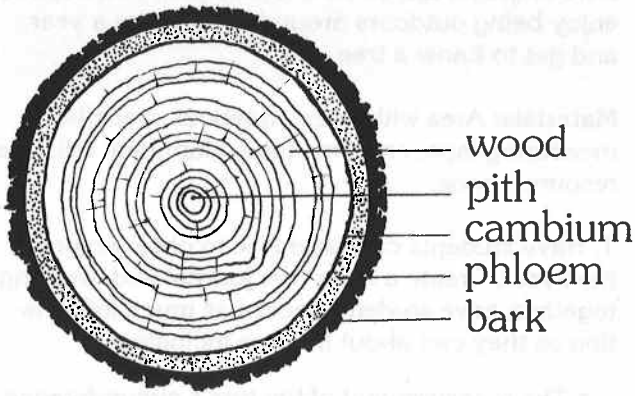
2. Help students identify the different layers of the tree and discuss their purpose.

The ***bark*** helps to protect the tree and can be used to identify the kind of tree. It is actually old layers of ***phloem,*** pronounced "flo em." The phloem, which is usually pinkish or reddish, carries the food produced by the leaves to all the parts of the tree. The ***cambium,*** which is very thin and may be too small for students to see, is the part of the tree that grows a new layer of wood and a new layer of phloem each year. The ***wood*** layer, which is most of the interior of the tree, helps support the tree and carries water, minerals, and salts up from the soil to the leaves. This is the part of the tree that contains the growth rings. It is also the part of the tree that carpenters use to build houses and furniture. The ***pith*** is the central core of the tree trunk and is the tree's first year of growth.

3. Have students count the number of growth rings in the wood to find the age of the tree their cookie came from. If the cookie is from a tree branch, the rings will tell the age of the branch which may be less than the age of the tree.

4. Explain that *dendrochronology* is the study of tree rings. Tree rings are studied to learn about past weather. Ask students to look carefully at the rings in their tree cookie. Tree rings from bad growing years (little rain or very cold) will be thin. Years that were mild with plenty of rain tend to be good growing years, so the rings from those years will be thick. Ask students to try to identify rings from good and bad growing years. They can compare tree cookies to see if there are similarities in the pattern of good and bad growing years.

5. Have them make a card telling the age of their tree cookie. Place all the tree cookies with their cards on a table so students can compare them. Mix-up the cards and challenge students to match each cookie with the correct card.



The Piggy In The Puddle

(GPN # 87)

Author: Charlotte Pomerantz
Illustrator: James Marshall
Publisher: Simon & Schuster

Science Comes Alive
Science Connected

Program Description: LeVar discovers how artists worked with clay animation to bring this feature book to life. He finds out how the characters and the puddle are sculpted and painted, and helps with the painstaking process of filming the action frame by frame.

May The Best Mud Win

Key Words: *mud, soil, sand, clay, mixing, observations*

Concept: *Different types of soils have different characteristics.*

Not all types of soil make good, gooey mud puddles like the one Piggy found. One way soil scientists group soils is by how much clay, silt, or sand particles they contain. Clay particles are very small, or fine. Silt particles are larger than clay particles. Sand particles are larger and coarser than either clay or silt. Soils containing mostly clay make great smooth, creamy mud puddles. Soils containing mostly sand will make rough, gritty puddles.

Materials: Powdered clay (available at art and school-supply stores), top soil (available at garden stores), sand (available at large toy stores and many garden stores), plastic cups, spoons, room temperature water, sheets of white paper, craft sticks, chart paper, markers, paper towels.

1. Prepare three types of soils by mixing powdered clay, topsoil, and sand in different amounts. ***Sandy soil***: four parts sand to one part clay and one part topsoil. ***Clay soil***: four parts clay to one part sand and one part topsoil. ***Topsoil***: four parts topsoil to one part sand and one part clay. Place small samples of the soils in separate cups, and label them.

2. Ask students to describe the mud in Piggy's puddle. How do they think the mud looks and feels? (*They might say the mud feels soft, smooth, and slippery and looks shiny.*) Write their responses on a sheet of chart paper. Tell them they will be examining three soil samples to find out which type would make the best mud for Piggy's puddle. Explain that the substances that make up the soil affect the kind of mud that soil makes.

3. Give each group samples of the three soils. Ask them to place a small amount of soil from a sample cup on a sheet of white paper. Have them examine and describe the sample using a craft stick as a probe and a hand lens for a closer look. Write their descriptions of the soil sample on chart paper. Have them return that sample to the cup and examine another sample. After they have examined and described all three soil samples, have them predict which sample will make the best mud when mixed with water.

4. Have students make mud by putting a spoonful of water in each cup and stirring the mixtures with craft sticks. They should continue adding spoonfuls of water until the mixtures are the consistency of pudding. Ask them to count and compare how many spoons of water each cup took. Then have them describe each mud sample and write descriptions of each on the chart paper. Finally have them tell which type of soil they think would make the best mud for Piggy's puddle, and explain why.

5. Have students place a small amount of mud from one of the cups on the back of their hands. Ask them whether the mud feels warm or cool. (*Cool*) Why do they think pigs like lying in mud? (*Pigs are not just attracted to mud because of the way it looks and feels; mud actually helps them stay cool in hot weather. People and other animals perspire to cool down, but pigs perspire very little. To stay cool, they roll in mud; the wet mud conducts heat away from their bodies. The mud also works as a natural sun block to protect pigs from sunburn.*)

Puddle Production

Key Words: *mud, soil, water, drainage*

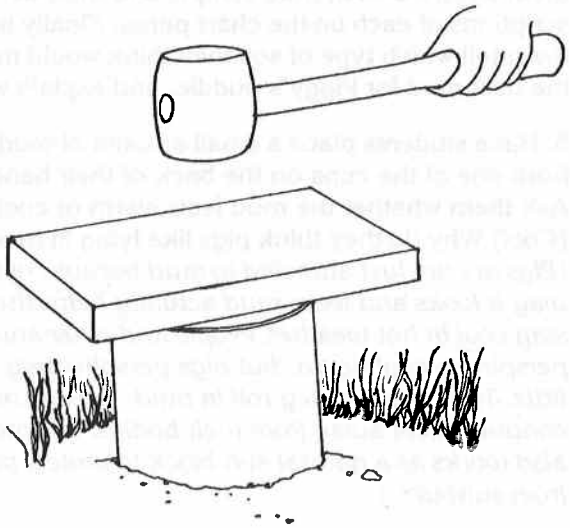
Concept: *Mud puddles form in places where soil drainage is poor.*

Mud puddles often form in the same places. They are found in places where the soil becomes saturated with water often because of poor drainage. Some soil types, such as sandy soils, usually allow water to drain away quickly. But soils that are high in clay or silt drain slowly. Another factor is the compaction of the soil; for example soil on a road may be compacted from cars driving over it, so it will drain slowly. The height and slope of the surrounding land is also a factor.

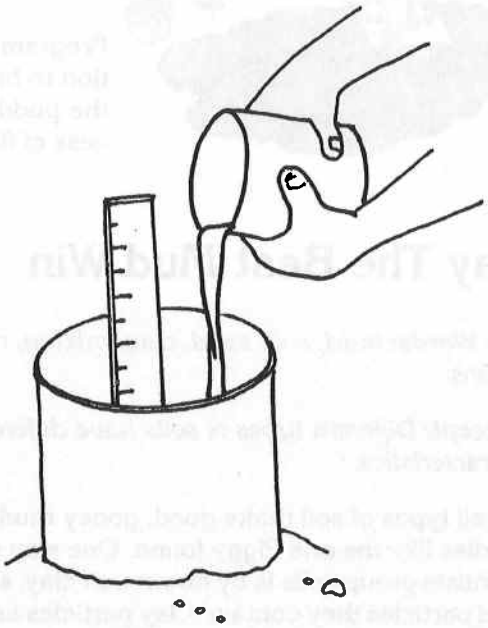
Materials: A large coffee can with the top and bottom cut off, large watering can, 2" x 4" x 8" piece of wood or other small solid board, hammer, ruler, watch, paper and pencil, school yard or other soil covered area.

1. Have students select a soil-covered spot in the schoolyard where they think a puddle will form. Ask them to make a simple map showing the selected location and to write a description of the soil there.

2. Help them push one end of a coffee can down into the soil about an inch. Be sure that the can is completely embedded in the soil so that water will drain down into the soil and not run out from under the can. If necessary have students step back while you place a piece of wood over the can and hammer on the wood to force the can down into the ground.



3. Have students pour several cups of water into the coffee can. They can measure and document how well the soil drains by placing a ruler upright in the can and timing how long it takes for the water level to go down an inch.



4. Help students repeat this process in other locations around the school. (*Areas with different amounts of traffic and soil types will tend to give visibly different results.*) Have them compare the drainage time from each location. In which area did the water drain most slowly? Most quickly? Or were the results similar? Why might the water have drained more slowly in some areas? (*Because of soil type, compaction, or the height and slope of the surrounding land.*) Have them predict which area might be the most likely to become a mud puddle.

Extension: Have the students look at the sampled locations shortly after a rainstorm. Did any of the locations produce a puddle? Were their predictions correct? Which areas dried most quickly? Were these the areas with good drainage?

Raccoons And Ripe Corn

(GPN # 77)

Author: Jim Arnosky
Publisher: Lothrop

Science Comes Alive
Science Focused

Program Description: Teeth marks on twigs are a good sign that beavers are nearby. A close look at tree trunks can yield signs of porcupine claw marks. Paw prints in the mud can indicate whether a raccoon stopped for a drink from the brook or just passed by. For a day of exploration, LeVar joins naturalist Jim Arnosky and discovers how much can be learned by observing wildlife clues.

Who Went There

Key Words: *inference, print, track*

Concept: *We can learn to make inferences from animal tracks.*

Naturalist Jim Arnosky sees signs of animals as inspiration for stories. His knowledge of animal behavior helps him infer what may have happened when he finds animal tracks in a particular place. Learn about animal tracks by making prints of them.

Materials: Field guides with animal (mammal, reptile and bird) track illustrations, thin styrofoam (such as meat trays), glue, scissors, cardboard, markers or pencils, flat dish, tempera paint, small and large piece of paper.

1. Have each student use the field guides to choose an animal track they can draw on a piece of thin foam; then cut it out and glue it to a thick piece of cardboard.

2. Put enough tempera paint in a flat dish to just cover the bottom and have students print the tracks by dipping the foam tracks into the paint and then pressing them onto paper.

3. Have students label and share copies of their prints with others so each student ends up with a labelled set of track prints. Ask them which kinds of tracks look most alike and what features help to tell them apart.

4. Put a large piece of paper on the floor. Have students print their tracks several times. After the paint dries, hang the paper up. Students can use their sets of labelled tracks to help identify those on the paper.

A Long Microhike

Key Words: *explore, observe, map*

Concept: *Exploring from an unusual perspective can lead to unexpected observations.*

We can discover much about nature by looking right under our feet to explore familiar, oftentimes overlooked, natural occurrences.

Materials: Toothpicks, string, paper, pencils.

1. Divide the class into teams of four. Give each team about ten flat toothpicks (for safety, snap the pointed ends off) and two strings—one eight feet long with the ends tied

2. Have teams choose an unpaved area for their microhike and begin by spreading their loop to mark the perimeter. Ask them to find points of interest (i.e., rocks, partially eaten leaves, insect homes, etc.) within the loop. They can mark these points by placing a toothpick nearby while being careful not to harm living things or disturb their homes. To complete the trail, use the length of string to connect the toothpicks.

3. Have the teams draw a map and describe each point of their microhike trail, and then share this with other teams.

Adept Adaptations

Key Words: *adaptation, thumb*

Concept: *Most body parts, such as thumbs, are adaptations that help living things live in their environment.*

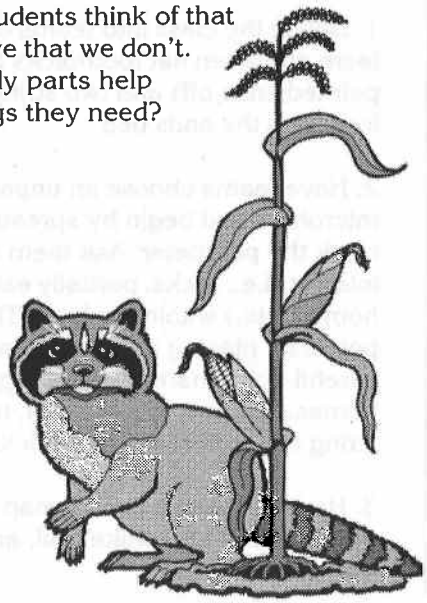
All living things have adaptations that allow them to adjust to the conditions of their environment (i.e. the small or narrow leaves of desert plants which reduce moisture loss, feathers that birds fluff up to retain body heat). An important human adaptation is our thumb which allows us to grasp and hold things such as tools and writing instruments, as well as many other things we do each day.

Materials: 3" x 5" cards with a hole punched along each three-inch side, crayons, string, masking tape.

1. Using masking tape, gently tape students' thumbs so they cannot move the tip of their thumbs by taping thumb to the side of the hand or to the palm. Provide each student with a string, crayon, and a 3 x 5 card with holes.

2. Have them complete the following. Fold the card in half so the holes match. Pick up the string. Put the string through the holes in the card. Tie the string ends together to make a loop. Write your initials on the card. Put the loop around your neck.

3. Discuss how thumbs influence what we can do and how that compares with other animals. What body parts can students think of that some animals have that we don't. How do those body parts help them get the things they need?



Nice Neighbors

Key Words: *food preference, observation, document*

Concept: *Different animals prefer different foods, which can be observed and documented.*

Birds as well as other animals have food requirements and preferences. Make a variety of simple bird feeders and explore the food preferences of wild birds.

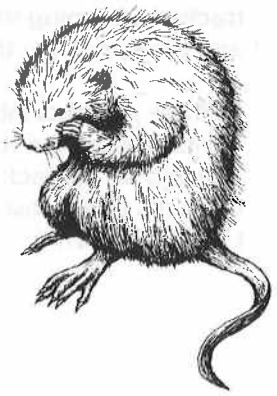
Materials: Fruit (e.g., apples, raisins), peanut butter, seeds (e.g., corn seeds, grass seeds, oatmeal, peanuts, sunflower seeds, beans), sticks, aluminum pie pans, wire, string, paper, pencils.

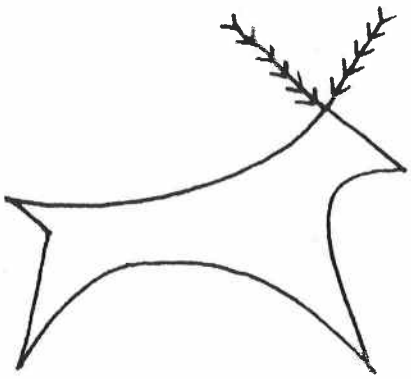
1. Create a bird feeder using a branched stick or by tying sticks across to make a perch. Spread peanut butter on the upper branch (so the bird can perch on the lower branch and reach the food). Sprinkle raisins or seeds (sunflower seeds, grass seeds, oatmeal, peanuts, etc.) on the peanut butter. Another bird feeder can be made by tying a piece of apple to a stick.

2. Attach hanging wire to the bird feeders and then, to help insure that the birds and not the squirrels are feeding on these treats, squirrel-proof the feeders using aluminum pie pans. Poke a hole through the center of a pie pan and push the hanging wire through. Let the pan slide down and rest above the feeder so it doesn't block the birds from feeding.

3. Hang the feeders in trees or on posts around the school (several feet from the ground so other animals can't get to it). If this isn't going to be an ongoing project, it's best to feed the birds in spring or summer rather than fall or winter when food is scarce and they begin to depend on this food source.

4. Have students observe the feeders morning, noon and afternoon to determine what birds use the feeders and when they use them. Document and compare findings.





Rechenka's Eggs

(GPN #84)

Author: Patricia Polacco
Publisher: Philomel

Science Comes Alive
Science Connected

Program Description: The author, Patricia Polacco demonstrates pysanky—a traditional Ukrainian egg-painting art, and shares how she got the idea for this story. LeVar decorates eggs, finds objects that are egg-shaped, and sees how they can be practical shapes for animal babies who emerge from them.

What A Relief

Key Words: *mixing substances, properties of water*

Concept: *Water cannot go through wax.*

Artist and author Patricia Polacco shows how Ukrainian egg dying, or pysanky, is done using layers of wax and different colors of dye to create detailed designs. This very old process known as wax relief works because wax and water do not mix, so new colors of dye cannot get to parts of an egg shell covered by a protective layer of wax. You can paint a design on paper using layers of wax and watercolor in much the same way as Patricia Palacco painted an egg.

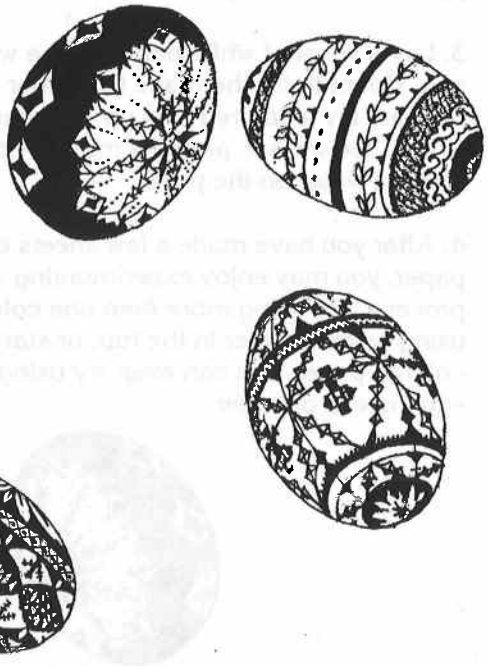
Materials: White construction paper, uncolored wax (or paraffin) candle, watercolor paints, water, pencil.

1. With a pencil, draw a simple geometric shape on white construction paper. Fill in a portion of the shape using an uncolored wax candle as if it were a crayon. Then paint the inside of the geometric shape yellow. As you paint, notice what happens to the watercolor paint in the portion of the shape with wax, and what happens in the areas without wax. The portion of the shape covered with wax will be protected from the dye and will remain white.

2. After the painting has completely dried (several hours later), use the wax candle to fill in another portion of the shape. Then paint the inside of the geometric shape orange. The portion of the shape covered with wax this time will remain yellow and the portion of the shape covered in Step 1 will continue to remain white.

3. Repeat Step 2, this time using red paint. Then again using brown paint. Be sure to let the painting dry completely before adding the wax and each new color.

4. After you have made this picture, you may wish to try making another picture using different colors or creating a more detailed design.



Just Marble-ous

Key Words: *mixing substances, properties of water*

Concept: *Oil and water do not mix.*

In addition to Ukrainian eggs, LeVar tells about several other decorated eggs including one created using marbleized paint, which can be made from oil and water-based paint. Like wax and water, oil and water also do not mix. Mix art and physical science to make marbleized paper.

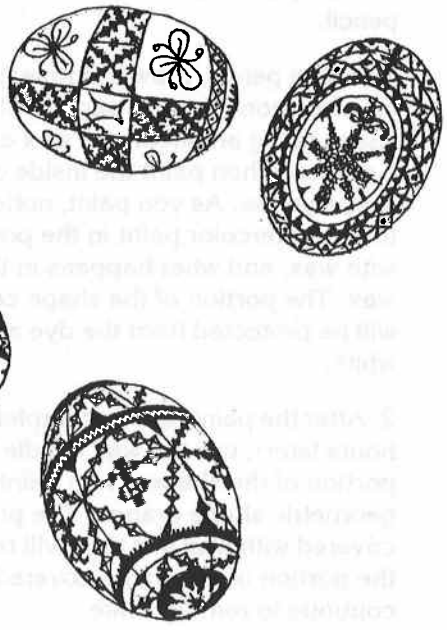
Materials: Small sheets of white paper about 4" x 6", a teaspoon, cooking oil, food coloring, a small clear jar with a lid such as a baby food jar, a pan or tub of water larger than the sheets of white paper, newspapers.

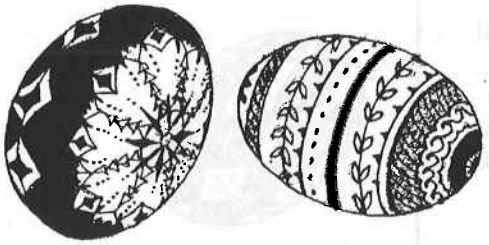
1. Place a teaspoon of oil and a teaspoon of food coloring in a jar and then put the lid on the jar. Look at the oil and food coloring in the jar. The food coloring is water based and does not mix with the oil. After making sure the lid is on tightly, gently shake the jar. Now what has happened to the oil and food coloring? Wait a few minutes and take another look. Shaking the jar caused the oil and food coloring to break up into small droplets of each, but after several minutes the oil and food coloring will be separated again.

2. Gently shake the jar again, then quickly take off the lid and pour the oil and food coloring into the pan of water. Gently stir the water.

3. Lay a sheet of white paper on the water in the pan. Count to 20 then take the paper out of the pan and lay it colored side up on some newspaper to dry. You will see patterns made by the oil and colored water on the paper.

4. After you have made a few sheets of marbleized paper, you may enjoy experimenting with the process. Try using more than one color of dye, using colored water in the tub, or starting with colored paper. You can even try using a boiled egg instead of paper.





The Salamander Room

(GPN # 94)

Author: Anne Mazer
Illustrator: Steve Johnson
Publisher: Knopf

Science Comes Alive
Science Focused

Program Description: There's more to creating an animal habitat than meets the eye. LeVar guides us through "JungleWorld," a simulated rainforest at the Bronx Zoo, and shows us how this incredible environment was created.

Right At Home

(And Other Good Ideas For Observing Animals)

Key Words: *wildlife, observation, safety*

Concept: *Safety must be carefully considered when observing animals in the wild.*

Because it's difficult to provide a good home for wild animals, the best way to observe them is in their natural environment. Here are important considerations for wildlife observation:

- Avoid activities that are likely to bring harm to the students or the animals.

- It's best not to touch animals. For example, the wings of many flying insects can be damaged if touched — such as butterflies whose powdery wing scales rub off easily and do not regenerate.

- Stay away from animals that can bite or sting.

When organizing an outdoor activity:

- Review the activity, as well as the ground rules, boundaries, and time limit with the class.

- Establish a site where students can come for help, and where they will meet when they are finished.

- For safety have students pair off in buddies, and instruct them to return to the meeting site if they get separated from one another.

- Use a whistle or familiar sound to signal time to return to the meeting site.

Dropping In For A Visit

Key Words: *home, observation*

Concept: *With care, animals can be coaxed from their homes and observed without harm.*

In nature every living thing has a home — and everything can be a home. Schoolyard trees and bushes are homes to many things. Some of these things can be gently coaxed to drop in for a visit.

Materials: Old bed sheet or large paper (white or other solid color), hand lenses, light rope with weight at one end (if necessary)

1. Locate a tree or bush with branches that hang over the ground. Avoid those with unsafe (e.g. wasps, bees) or nesting animals (e.g. birds).

2. Have students look closely at the leaves, branches, and trunk to locate (but not touch) any living things.

3. Spread a bed sheet or paper under an over-hanging branch, and gently shake. To reach a tall branch, toss the weighted end of the rope over a medium sized branch and shake gently. (Students should stand away so nothing falls on them.) The shaking action will cause small animals to drop off the branch onto the sheet much like the wind blowing them out of the tree.

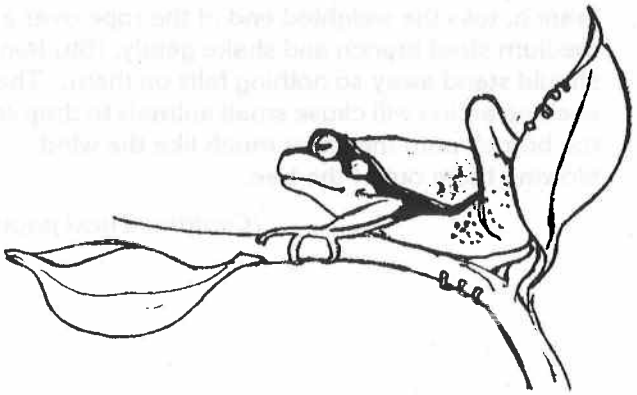
(Continued next page)

Dropping In For A Visit (continued)

4. Ask students to take turns describing one of the small creatures (these animals should not be touched) while classmates see if there are others that fit the description.

5. Have students sketch pictures and write descriptions of these animals so they have a reference for formally identifying them later.

6. When finished, gently lift the sheet so the animals slide down to the base of the tree, where they can continue their activities, hopefully no worse for having made the visit.



Dining Out

Key Words: *food, attract*

Concept: *Different animals are attracted by different foods.*

Uninvited picnic "guests" are typically insects that are attracted by the food. Discover what kinds of food interest insects the most. (Avoid doing this in extreme temperatures or in wet weather so the insects aren't harmed.)

Materials: Small containers (film containers, plastic test tubes, plastic cups), small food samples (avoid foods that may become rancid quickly — e.g meat, dairy products — and foods that insects may stick to), tools for digging (hand trowels or heavy spoons), clear plastic wrap, rubber bands

1. Find an area that is generally undisturbed by people. Dig holes the size of the containers. Place containers in the holes so that each will be flush with the ground.

2. Place a pea-sized food sample in each container (small amounts are less likely to attract large animals such as raccoons). Record the location and food sample for each container.

3. Return in several hours and cover each container with a piece of plastic wrap before removing it from the hole. If there is a dinner guest inside, secure the plastic with a rubber band. If the insect could cause harm, release it carefully.

4. Record which insects came to dinner and which food attracted them. Were there any similarities in the foods that attracted the most insects? What kinds of insects were most often attracted?

5. After observing the insects, remove the plastic, lay the container on its side by the hole so the insects can find their way out. Later collect the containers.

One, Two... Tree

Key Words: *observations, model*

Concept: *Observation can be enhanced by building a model.*

Plan a tree-focused nature walk to collect information and observations in preparation for creating realistic tree models.

Materials: Crayons, chalk, paints, brown paper (e.g. grocery sacks), newsprint paper

1. During a nature walk, each group of students should choose a tree to observe for their model. Discuss the shape of the leaves, their variation in color, and estimate how many are on the tree. Collect several leaves (1-2 for each group member) to take back.

2. Study the trunk shape and coloration, and observe the branches and the shape of the tree. Make a sketch of the trunk, branches, and tree shape for later reference. Estimate the height of the tree and the width of the broadest point.

3. Back in the classroom, each group can decide the height, trunk size, branching pattern, and canopy shape of their model tree. Once the shape is outlined, use brown paper to create the trunk; use rubbings of the collected leaves to create the tree canopy.

4. Strive to make the models as realistic as possible — using paint or chalk to add color variations in the trunk, and paint or paper to vary the color of the leaves. Assemble these trees in a classroom or hallway.

Animal Rooms

Key Words: *ecosystem, habitats, diorama*

Concept: *Models of places, called dioramas, can help us understand habitats and ecosystems.*

Animals live in very complicated ecosystems. Explore these complexities by doing research on an animal and creating diorama habitats.

Materials: Plastic animals or animal pictures, small boxes, construction paper, arts and crafts materials (pipe cleaners, clay, egg cartons, glue, etc.)

1. Have the class list the information they will need to know before creating an animal habitat diorama. This should include things the animal needs to stay alive and satisfied and, to emphasize that every animal has many roles in its ecosystem, it should include living things that depend on that animal.

2. In pairs or alone they can choose animal subjects, do research and then create a diorama habitat.